JOURNAL
of
FARM ECONOMICS

Joint Sessions with other Professional Associations
Detroit, Michigan, December 27-30, 1954

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Price: $5 per year, this issue $1.25

Entered as second class matter at the post office at Menasha, Wis. Acceptance for mailing at a special rate of postage provided for in the Act of February 28, 1925, paragraph 4, section 412, P. L. & R., authorized November 27, 1931. Printed in U.S.A.

THE JOURNAL OF FARM ECONOMICS is published five times a year during February, May, August, November and December by The American Farm Economic Association. Yearly subscription $5. Published at Menasha, Wisconsin.

JOURNAL
OF
FARM ECONOMICS

Volume XXXVI NOVEMBER, 1954 Number 4

INDUSTRIAL MANAGEMENT TECHNIQUES IN AGRICULTURE

J. E. Wills
University of Illinois

IN RECENT years the terms *farm work simplification* and *agricultural work simplification* have identified "the application of the industrially developed techniques of scientific management and methods engineering to farm work"[1] and to marketing and processing of farm products. It is the purpose of this article to trace developments in the ten or more years of work simplification projects and the contributions of work simplification and other industrial management techniques to agricultural research, teaching and extension.

Industrial management developed in the management movement originated by Frederick W. Taylor. The movement had engineering as its parent discipline, and its original concern was with improving work methods. The field was broadened with development of operations planning and control techniques, and with increasing emphasis on the human element and personnel relations. Agricultural applications of industrial management techniques have been largely limited, however, to those aimed at improving work methods, that is, to work simplification.[2]

Application of these techniques to agriculture is obviously influenced by differences in the nature of industrial and agricultural work and in their operational settings. In general, agriculture is characterized by: (1) lack of opportunity for specialization of labor, influenced by small scale of individual farms (with few workers employed) and by many diversified tasks that are not highly repetitive; (2) necessity of performing operations se-

[1] L. M. Vaughan and L. S. Hardin. *Farm Work Simplification*, John Wiley and Sons, 1949, p. 3. See also foreword by E. C. Young.

[2] In methods improvement the key techniques are those of motion and time study. Ralph M. Barnes, in *Motion and Time Study*, lists the objectives of motion and time study as "(1) finding the most economical way of doing . . . work; (2) standardizing the methods, materials, tools and equipment; (3) accurately determining the time required by an average worker to do the task; and (4) training the worker in the new method."

quentially rather than simultaneously; (3) large space requirements and, for most operations, necessity of taking the machine to the work rather than taking materials to the machine; (4) the multiple role of the farmer as worker, manager, and executive; and (5) close interrelationship between the business and the household.

Because of these conditions it is frequently implied that "what has come to be known as scientific management in industry does not find in the agriculture of the United States a very good medium in which to develop."[3] This generalization is obviously related to primary production operations on the typically small, relatively diversified farm. When marketing and processing are considered as agricultural work a good deal is included that approaches, or becomes identical with, industrial work. Even in general farm operations there are wide variations in nature of the work, and the application or modification of methods improvement techniques is affected accordingly. The crux of the problem is the extent to which industrial work and farm work can be reduced to common elements and common terms, and the extent to which management problems arise under essentially similar conditions. And it is evident that, with recent technological advances, the organization and the operational problems of farms are taking on more and more of the characteristics of business or industrial units. To the extent that this is the trend, application of industrial management techniques has increased significance both in the actual management of farms and in agricultural research and teaching.

Enterprises or Operations Studied

In the early years of the National Farm Work Simplification Project, emphasis was on farm work, and mainly on crops requiring a good deal of seasonal hand labor. Wartime scarcity of workers was a major stimulus to these projects, and specific job training aids were a primary objective. By 1951 and 1952 a marked shift had taken place; fewer projects dealt with farm work and many more dealt with marketing and processing operations (Table 1).[4] The shift may be attributed to: (1) easing of the seasonal labor situation, influenced to some extent by machine methods of performing hand jobs; (2) increase in marketing research under the Research and Marketing Act; and (3) the fact that industrial management techniques are more readily adapted to marketing and processing situations than to farm work.

[3] Black, Clawson, Sayre and Wilcox, *Farm Management*, Macmillan, 1947, Chapter XXV.

[4] Data in Table 1 do not measure change in the extent of work simplification activity between the two periods. They are not complete inventories of projects. Also, it is generally true that the later projects are broader in scope, and some are not readily classified on the basis of enterprises studied. They deal with broad functions rather than single enterprises or operations.

Research Developments

With noteworthy exceptions farm work simplification studies of the "trial period" of 1943-45 frequently exhibited the following characteristics:

1. They were narrow in scope, often limited to a single operation or enterprise.
2. Alternate methods were studied, as used by different individuals or on different farms, and with results expressed as a comparison of average time and/or travel required. In some cases results were not obtained in sufficient detail to explain differences in total time or travel.
3. There was little "rating" of the time required in an individual case studied, and little leveling to a standard rate of performance.

TABLE 1. NUMBERS OF AGRICULTURAL WORK SIMPLIFICATION PROJECTS AND SUBPROJECTS IN TWO PERIODS

Enterprises studied	1943–45[a]	1951–52[b]
Crop production	(24)	(6)
Truck crops and fruits	13	2
Forage crops	4	2
Other crops[c]	7	2
Livestock production	(8)	(5)
Dairy	4	4
Poultry	2	0
Meat and animals and general	2	1[d]
Marketing and processing	(3)	(18)
Milk plants and routes	0	8
Fruit and vegetable packing sheds	1	3
Canneries	2	0
Warehouses[e]	0	3
Locker plants	0	1
Wholesale and retail groceries	0	3
Miscellaneous	0	2[f]
Total	35	31

[a] As reported in "Two Years of Farm Work Simplification Research," F.W.S.P. Publication No. 2, Purdue University, September 1945.

[b] As reported in "Agricultural Work Simplification News Letter," Nos. 22 and 23, Purdue University, September 1951 and December 1952.

[c] Includes potatoes, tobacco, sugar beets, and grain crops.

[d] Manure hauling.

[e] Tobacco, cotton, and public refrigerated warehouses.

[f] (1) Laboratory research on fundamentals of work simplification.
(2) Soils testing laboratory.

4. There was relatively little developing (or synthesizing) and testing of new methods not observed in cases studied.
5. Output per hour or time and travel required for a given output were the principal criteria with little analysis of costs of quality of product.

6. Relatively little attention was given to the sampling of cases studied or to tests of validity and applicability of results.

To a large extent the nature of early projects is explained by their wartime setting. Furthermore, techniques were being applied in a new field with many variables difficult to control. In view of circumstances the early studies were remarkably successful in applying the techniques and in obtaining useful results.

A review of recent studies reveals sound development, marked by broadening of the scope of individual projects and more complete application of methods improvement techniques.

A broader approach is indicated in a number of projects, each of which is concerned with forage harvesting. In New York five different *patterns* of forage harvesting were studied.[5] Although this was not a complete work simplification study, it was a considerably broader approach than study of a single crop or a single harvesting machine. In Indiana forage harvesting methods were studied as an integral part of the whole forage problem, including production, harvesting, storage and feeding.[6] Of particular significance is the inclusion of work simplification techniques or results in broad projects in which production efficiency of the whole farm is the criterion. In Michigan a study of dairy costs[7] made extensive use of results of other studies that employed work simplification techniques. Such techniques have a similar place in the broad study of New England dairy farms.[8]

There is obvious relationship between the different limitations of early work simplification projects. If job analysis is in insufficient detail, it is not possible to explain differences in alternate methods, develop standard rates of performance, or synthesize new methods from observed methods. The Indiana forage-handling project[9] illustrates analysis that makes possible the application of these various techniques. For the baling and chopping processes, man and machine analysis data were summarized according to cycles, and within each cycle observed time was broken down

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[5] L. C. Cunningham and L. S. Fife, "An Analysis of Forage Harvesting Patterns Used on Dairy Farms, New York, 1952," Cornell University, A.E. 933, October 1953. The five patterns include (1) hay and corn silage harvested with hay loader and ensilage cutter; (2) hay and corn silage harvested with baler and ensilage cutter; (3) hay and corn silage harvested with baler and field chopper; (4) hay, grass, and corn silage harvested with field chopper and baler; and (5) hay, grass, and corn silage harvested with field chopper.

[6] R. W. Schoeff, "Economic Analysis of Forage Production, Harvesting and Storage," Ph.D. thesis, Purdue University, 1952. See also "Agricultural Work Simplification News Letter," No. 22, September 1951, Purdue University.

[7] C. R. Hogland and K. T. Wright, *Reducing Dairy Costs on Michigan Farms*, Mich. Agrl. Exp. Sta. Special Bul. 376, May 1952.

[8] I. F. Fellows, G. E. Frick and S. B. Weeks, *Production Efficiency on New England Dairy Farms: A Preliminary Appraisal of Cost Reduction Opportunities*, Storrs Agrl. Exp. Sta. Bul. 283, January 1952.

[9] R. W. Schoeff, op. cit.

into elements. From this analysis "possible" or "standard" time was built up, with the processes synchronized to eliminate delay, and with allowances introduced. Specific assumptions were made as to equipment used, size of load, and distance of haul, and separate build-up was made for different-sized crews.

In a dairy study[10] work simplification techniques were employed to develop suggested methods for which daily (and annual) chore time was built up, for specified size of herd, buildings and equipment, milking routine, and feeding practices. In an Indiana milk plant study, detailed production standards were developed for operations in one-man and two-man receiving rooms.[11] Specific conditions assumed for all arrangements, total daily volume, number of producers, and distribution of producers by volume were those most representative of plants studied. Total standard time was set up for three operating speeds: normal operating speed with and without personal allowance, and maximum operating speed without personal allowance. A Vermont project featured development and complete description of the "Norma" milk receiving plant, a synthetic plant in which are incorporated many of the findings growing out of a work simplification study of 12 plants in northern New England.[12]

Increased emphasis on cost analysis is evident in the titles and in the methods of many recent projects. The Kentucky dairy project and the Indiana forage-handling project have already been mentioned. Cost analysis was a feature of a Kentucky study of loading tobacco at auction warehouses.[13] In the California study of efficiency in fruit marketing, emphasis is on shipping-point costs as influenced by equipment, plant layout, and work methods.[14]

The effect of work methods on yield and quality of product must be anticipated and studied. Quality of product was an important consideration in the early work simplification study of celery harvesting in Florida.[15] Yield, quality and value of the crop were the central consideration in a later study of work methods in burley tobacco production.[16]

[10] George B. Byers, *Effect of Work Methods and Building Designs on Building Costs and Labor Efficiency for Dairy Chores;* Ky. Agrl. Exp. Sta. Bul. 589, June 1952.

[11] Charles E. French, G. B. Wood, and V. C. Manhart, *Labor Utilization in Receiving Rooms of Indiana Milk Plants,* Agrl. Exp. Sta. Bul. 576, July 1952.

[12] R. M. Carter, K. P. Brundage, and Alec Bradfield, *Labor and Equipment Use in Milk-Receiving Plants,* Vermont Agrl. Exp. Sta. Bul. 563, September 1951.

[13] Dana G. Card, George B. Byers, and Wendell C. Binkley, *Effect of Work Methods on Time and Ease of Loading Baskets of Tobacco in Sales Warehouses,* Ky. Agrl. Exp. Sta. Bul. 572, December 1951.

[14] R. G. Bressler, "Efficiency in Fruit Marketing: Marketing Costs for Deciduous Fruits," Cal. Agrl. Exp. Sta. Mimeographed Report No. 127, May 1952. Subsequent reports deal with individual phases of this project.

[15] Max E. Brunk, *Celery Harvesting Methods in Florida,* Fla. Agrl. Exp. Sta. Bul. 404, November 1944.

[16] George B. Byers, Charles E. Bortman, and William B. Back, *Effect of Maturity and Priming of Burley Tobacco on Yield, Quality, and Labor Requirements of the Crop,* Ky. Agrl. Exp. Sta. Bul. 552, May 1950.

One of the most difficult parts of a work simplification study is getting improved methods adopted and tested. The difficulty increases as more complex operations are studied and as scope of the research is broadened. The Indiana study of milk-receiving plants is a good example of a project carried through this important step.[17]

From this review of selected projects we draw two conclusions: there have been significant improvements in research procedures, and work simplification as a tool is finding its place as an integrated part of agricultural research programs. Used in conjuntion with statistical analysis and other research procedures it is a valuable tool in various agricultural fields. Experience supports the view expressed by Young and Bierley in 1943: "work simplification provides a comon meeting ground for economics, engineering, and the plant and animal sciences. It cannot be properly classified as belonging to any one of these fields.[18]

Teaching Work Simplification

In the few agricultural colleges where special courses in work simplification are taught they are offered in departments of agricultural economics. Textbooks used in regular farm management courses have chapters or sections of chapters on work simplification; and students' contacts, mainly with results of work simplification studies, are increasing in courses of other departments. Thus work simplification is being included in teaching programs, but little specialized training in the field is being offered.

Objectives of courses taught in this area are: (1) developing in the student a criticial attitude toward existing methods, an awareness of possibilities of improving methods; (2) developing the student's ability to analyze and improve his own methods; (3) equipping students with tools needed to make relatively simple work simplification studies; and (4) thorough training for work simplification research. Objectives 1 and 2 are common to many other courses. Students indicate, however, that work simplification courses assist them materially in critical and logical thinking. Objective 3 is rarely achieved without placing the student in a problem solving situation, and without a separate course this is seldom possible. If we are to do research in this area and with these tools, objective 4 will have to be achieved somewhere in the educational program.

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[17] Charles E. French, *Research Procedure in Evaluating Milk Receiving Labor in Indiana,* Purdue University, Agrl. Exp. Sta. Bul. 575, June 1952, p. 19. "Four new methods were installed and tested under plant conditions. The operators were trained in the new methods. Complete time studies were taken of the new methods in operation. The actual performance varied only slightly from estimated performance." This publication is a very good description and evaluation of research procedure.

[18] E. C. Young and Ivan R. Bierley, "The Future of Farm Work Simplification Research," *This Journal,* February 1946.

Work Simplification in Extension

Work simplification has much to offer the agricultural extension program, both in research results and in the analysis techniques themselves. General extension objectives are to help managers of farms or agricultural businesses (a) perform specific operations or tasks more efficiently and (b) do a better pob of planning their programs. Teaching efficient ways to perform specific operations is difficult in a general farm situation where work is done by the self-employed farmer, and where many operations are not highly repetitive and are performed under widely varying conditions. Since it is not possible to set up specific instructions for all jobs and for all situations there is a place for teaching principles and a self-analysis procedure by which the farmer can improve his own methods. As an adaptation of Job Methods Training the "principles" approach has been tried out in agricultural extension.[19] How successful it has been is not evident, but it certainly merits continued effort.

Results of work simplification research have a particularly strategic place in planning the individual farm or business. Farm planning is an extension activity of more or less importance in all states. In planning there is need for much information variously referred to as "production standards," "rates of performance," "input-output data," or "production functions." Deficiences in information of this sort are universal. It is a direct objective of work simplification studies to obtain standard data with respect to productivity and cost of labor, equipment and buildings. Standards obtained by work simplification techniques are superior to those obtained in the usual historical studies in that they are related to well-defined methods and operating conditions, and in that they can be forward looking, with standards for methods not actually observed.

With changes in technology farmers are continually faced with making decisions regarding their production methods. New ideas are brought to their attention, particularly through the impressive number of magazine articles featuring work methods, mechanical equipment and buildings. How does the farmer decide which ideas or practices it would pay him to adopt? And how can the extension program help him make sound decisions? It goes without saying that a sound extension program is dependent on sound research. It is asking a great deal to suggest that research and extension programs can keep pace with all the technological developments in farm practices. But this is the challenge. Tested results can be obtained in work simplification studies. As they are obtained, effective means must be sought to make them quickly and generally available to farmers.[20]

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[19] Roy E. Proctor, "Extension Use of Farm Work Simplification," *This Journal*, February 1946. See also L. S. Hardin, "Study Your Own Work Methods," Purdue University, Cir. 307, 1947.

[20] The problems briefly discussed in this section are closely related to decision-

Industrial Management and Agricultural Economics

So far our discussion has been limited to methods improvement techniques, and the subject has been considered largely from the standpoint of agriculture in general rather than of any one agricultural discipline. We are now concerned with other industrial management techniques and their applications in the fields of agricultural economics.

C. H. Zuroske describes five major management functions, specific techniques associated with these functions in industry, and their use in agriculture.[21] The major management functions are: (1) planning combinations of enterprises, (2) operations planning, (3) operations control, (4) operations methods improvement, and (5) personnel cooperation. A chain of relationships may be summarized as follows: Industrial management attempts to find laws to replace rule-of-thumb guides to decision-making and execution. Laws of the situation are discovered through research; on the basis of research, standards are developed; on the basis of standards, plans and schedules are developed; on the basis of plans and schedules, control is achieved; effective control necessitates personnel cooperation.[22]

Let us look at those industrial management techniques that have or might have important applications in farming and in farm management. Specific techniques in planning combinations of enterprises are alternate budgets, cost accounting, and its adjunct, break-even analysis. Alternate budgets are used more widely in farm management than in industry. The expense involved in cost accounting, and complex joint-product relationships limit use of cost accounting in farming. In both farm management and industrial management it is accepted that the decision to add or delete an enterprise or volume of product is properly based on differences in net returns from the business as a whole, and not on allocated costs and returns from the individual enterprise or product.

Operations planning and control are of major importance in industrial management. Specific techniques are production planning (scheduling), cost-planning, and sales planning, and production control, cost control, and sales control. Farmers have informal mental operations plans, but very seldom in detail: without practical plans operations control is not possible. The term *operations planning* is seldom found in farm management literature; yet there is a good deal in the literature that implies operations planning. One has only to refer to discussions of seasonal

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making principles and expectation models being developed by agricultural economists. See Glenn L. Johnson and Cecil B. Haver, *Decision-Making Principles in Farm Management*, Ky, Agr. Exp. Sta. Bul. 593, Jauary 1953.

[21] C. H. Zuroske, "A Study of the Application of Industrial Management Techniques to the Management of Agricultural Enterprises," Ph.D. thesis, Purdue University, 1951.

[22] Note the parallel of Zuroske's five areas and the five knowledge areas distinguished by Johnson and Haver. *Op. cit.* footnote 20.

labor requirements; planning and scheduling work, feeding livestock for certain rates of gain or production levels, when to market, seasonal production so that marketings coincide with higher prices, ways to reduce costs, etc. Recent studies of farmers' expectation models, risk and uncertainty, insurance principles, etc., also have the objectives of a better understanding of how farmers plan and of helping farmers do a better job of planning their operations.

Operations control has been largely neglected in the discipline of farm management. This follows from the lack of definite operations plans and from the real difficulty of controlling production and costs in farming. As suitable planning information becomes increasingly available we should expect farmers to move in the direction of the industrial management concept of definite operations plans against which performance is checked *currently*.[23] Farm management workers will continue to emphasize the planning function but it is likely that the control function will become a matter of increasing concern.

As specific techniques in personnel cooperation, Zuroske discusses personnel testing and training, financial incentives (bonuses, profit-sharing, etc.), and nonfinancial incentives.[24] It is unnecessary to dwell on reasons for the greater emphasis on personnel relations and management in industry than in farm management. Farm management textbooks, a few research bulletins, and a sizeable number of extension publications deal with such subjects as training hired workers, relations between the farmer and his hired help, wages, bonuses, housing and privileges for workers, etc. There is need for more research on these subjects, fundamental research aimed at helping farmers improve their "personnel management." Basic research on financial and nonfinancial incentives should be extended to include farmers as well as hired workers. Studies of farmers' motivation are in this category.

The place of industrial management techniques in marketing can be briefly summarized: many marketing studies have an essentially industrial setting, and industrial management techniques are readily applied. Adaptabiltiy of these techniques to studies of marketing and processing costs is evident in a number of recent descriptions of research procedure. Thompson's analysis of theory and practice of methods engineering (work simplification) techniques applied to agricultural work is directed mainly at marketing processes.[25] Charles E. French describes in detail a research

[23] Numerous examples illustrate this trend. Note the number of farmers using a carefully planned fertilizer program aimed at producing a specified yield, or a livestock feeding program aimed at a specified rate of gain. The poultryman who keeps layers in individual cages and replaces them when they fall below a particular rate of production is practicing a high degree of production planning and control.

[24] *Op. cit.*

[25] Jack C. Thompson, "The Techniques of Methods Engineering Applied to Agricultural Work—Theory and Practice," Ph.D. thesis, Cornell University, 1952.

procedure by which industrial engineering methods can be adapted to marketing studies in general.[26] Two papers presented at the 1953 meeting of the American Farm Economics Association have the significant titles, "Economic-Engineering Methods in Marketing Research"[27] and "Evaluation and Use of Cost Functions in Iowa Creameries."[28] Both describe research procedures in which engineering analysis is thoroughly integrated with economic analysis.

Summary

Industrial management techniques have not been as well integrated into farm management as they have into marketing research, but such integration is developing. The disciplines of farm management gains a great deal by inclusion of work simplification and other industrial management techniques.

Whether farm management workers employ the budgeting method or more formal statistical analysis of resource allocation, they need the same types of physical reference data. Work simplification techniques are particularly well suited to obtaining such data with respect to inputs of labor, machinery, and buildings.

Industrial management techniques strengthen the operation side of farm management. They result in information that is particularly useful to farmers in planning and executing their operations. Production economics alone does not provide all of the tools needed by the farm manager. At any given time the essence of the farmer's problem is less likely to be one of allocating resources to the point of equi-marginal returns than one of how to perform a necessary sequence of operations once he is committed to a particular productive organization or investment.

Work simplification deals with labor and with cost analysis, traditionally in the field of farm management. The whole field of labor utilization, the human factor in agricultural production, is the responsibility of agricultural economists.

There are many parallels of concepts and methods in industrial management and concepts and methods being widely promoted by "new school" farm management workers.

[26] *Op. cit.*
[27] L. L. Sammet and B. C. French, *This Journal,* December 1953.
[28] Henry A. Homme, *This Journal,* December 1953.

THE CASE FOR THE MAIL SURVEY*

ROBERT C. KRAMER AND JAMES D. SHAFFER
Michigan State College

Introduction

FOR YEARS the mail survey technique has been under fire from the academic research worker and writer. A great deal has been written on the disadvantages of the method—especially with respect to the biasing effect of the non-respondents—but little has been done to really evaluate the technique or to minimize the disadvantages in order to exploit the many advantages it offers.

While the academic researcher has tended to shy away from the mail survey, the commercial firms—the people who put up their own money for research—have apparently been overwhelmingly in favor of the mail survey, at least for market research studies. This is indicated by the fact that over the past ten years approximately 90 percent of all the revenue received for market research by commercial research firms has been from studies conducted by mail.

The purposes of this paper are: (1) to discuss the advantages and disadvantages of the mail survey and to suggest methods and procedures by which the disadvantages may be reduced or eliminated and the advantages more fully exploited; and (2) to report the findings from an empirical study of the bias resulting from the use of a mail questionnaire.

Advantages and Disadvantages

The Marketing Research Committee of the American Marketing Association[1] reports the major advantages and disadvantages of the mail survey method to be as follows:

Advantages:

1. A low per unit cost (as compared with a similar personal interview).
2. A wide geographic distribution of respondents is possible.
3. It is useful in reaching specific classes of people (executives, retailers, home owners, etc.).
4. There can be no interviewer bias.
5. No identification of respondents is necessary; hence it is possible to obtain more honest replies than with the short-answer type of personal interview.

Disadvantages:

1. It is impossible to know whether the intended person answered and whether or not he consulted others.

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* Journal Article No. 1628, Michigan Agricultural Experiment Station.

[1] Market Research Techniques Committee of the American Marketing Association. "Questionnaire preparation and interviewer techniques." *Jour Marketing*, Vol. XIV, No. 2, October 1949, p. 410.

2. It is difficult to obtain detailed qualitative answers or to know precisely what the offered responses mean.
3. The questionnaire must be short.
4. It is difficult to obtain a really representative list of the universe required.
5. Those who reply are probably not typical members of the list (those especially interested, or those particularly in opposition to the ideas presented have been shown to be most likely to reply).

The case for the mail survey must be built upon a comparison of the mail method with alternative methods. No survey method, at our present state of knowledge, is perfect, nor is one survey technique superior to another per se. Thus, in considering each of the disadvantages listed above, one must ask: (1) Is this a factor which could significantly affect the results of the survey? (2) Does this disadvantage simply limit the scope of the survey technique or does it rule this technique out for certain types of problems? (3) Is this disadvantage unique to this particular survey technique or is it common to the alternatives also? And finally, (4) is it possible to attenuate the effects of the disadvantages?

What can be said concerning the first advantage listed above? It is true that it is impossible to know for sure whether the intended person answered the mail questionnaire. However, it is almost certain that the mail questionnaire will get to the selected address. In comparing mail with personal interviews there is little doubt that the odds are in favor of the mail questionnaires reaching the selected address, if specific addresses are known in advance. In many surveys it is not particularly important which member or members of the family answers the questions as long as the questions are properly framed. Most personal interview surveys settle for the member of the family found at home, for to do otherwise increases the cost. In regard to the possibility of the respondent receiving assistance in completing the questionnaire, it should be noted that this may be desirable—especially in consumer surveys involving commodities which might ordinarily be bought by more than one member of the family. The authors believe that in very few instances would the possible influence of a second party be as biasing in effect as the presence of a personal interviewer.

The second disadvantage, that it is difficult to obtain detailed qualitative answers or to know precisely what the responses mean, also imposes certain limitations on the mail survey method in that it restricts the extent to which the survey can be used. The technique remains valid for many types of studies. Each questionnaire should be given much thought before it is pretested. And, every questionnaire should be pretested. The results from the pretest will give valuable ideas as to how to revise the questionnaire so that respondents will interpret the questions correctly and provide answers that are usable.

Actually, techniques have not been contrived which provide detailed qualitative data on a mass survey scale. Depth interviewing is promising, but the lack of trained interviewers severely limits the application, even in the personal interview.

There has been very little research reported indicating the optimum length of the questionnaire for either the mail or personal interview survey. The length of the questionnaire is only one of the factors influencing the rate of return.

The most important question with respect to the mail survey is, can it provide a representative sample? The last two disadvantages listed above indicate that it is difficult, if not impossible, to obtain a representative sample by means of a mail survey. Since this is a crucial problem with respect to the survey technique, much of this paper is devoted to this problem.

For many types of surveys it is only practical to draw the sample from established lists. In this case the lists are as representative when used for a mail survey as for any other. State registration provides a complete listing of many types of businesses, for example, food locker plants.[2] For consumer surveys city directories can be obtained for many cities,[3] containing accurate listings of addresses by streets.[4]

With proper cooperation from postal authorities, it might even be possible to use area sampling for a mail survey. This could be accomplished by using the mail route, either city or rural, as the basic sampling area, selecting the areas at random or at random within strata, and then mailing questionnaires to all or part of the box holders of the routes selected.

It may be that a city directory or other list does not embrace the entire sample area. In this case two or more sampling procedures may be followed, each adapted to a particular portion of the sample area according to the information available. Just as more than one sampling procedure may be used to advantage in a particular survey, so may more than one survey technique. There is no reason for giving up the use of the mail for that part of the survey for which listings are available just because the whole area is not listed.

The first and most important factor affecting the representativeness

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[2] Since in many cases these types of businesses are widely dispersed geographically, the mail survey becomes particularly applicable.

[3] For example, in Michigan, city directories are available for 41 of the largest cities and towns which include the bulk of the population of the state.

[4] The accuracy of the listings of the city directories, of course, varies with the "age" of the directory. Thus, timing the mail survey to coincide with the publication date of a directory would increase the accuracy of the list. The list might also be brought up to date by supplementing the directory with addresses of homes constructed since the completion of the directory. These could be obtained from building permit listings. Also, the list could be checked with the current telephone directory.

of the response is the size of that response. The mail technique can be improved by employing devices designed to increase the rate of response.

There is evidence that in a mail survey there is a fairly large group of marginal cooperators who may or may not return the questionnaire, depending on something other than their basic attitude toward cooperating in a particular case. In a test-tube study conducted by one of the authors in Owosso, Michigan, mail questionnaires were sent on two different occasions, six months apart, to 144 previously surveyed families. In each case the questionnaire was almost exactly the same, as was the letter of transmittal. A summary of the returns is provided in Table 1.

TABLE 1. RETURNS OF MAIL QUESTIONNAIRES FROM TWO DIFFERENT MAILINGS OF THE SAME QUESTIONNAIRE TO THE SAME SAMPLE IN OWOSSO, MICHIGAN, 1949 AND 1950

Item	Number	Percent
Total families in sample	144	100
Returned first questionnaire	59	41
Returned second questionnaire	59	41
Returned both questionnaires	34	24
Returned only one questionnaire	50	35
Returned at least one of the questionnaires	84	58

It will be noted from the table that while a 41 percent return was received on both occasions it was not entirely from the same families in each case. Only 24 percent of the total sample returned both questionnaires, while 35 percent of the total sample returned the questionnaire on one occasion and not on the other.

TABLE 2. RETURNS FROM TWO MAIL QUESTIONNAIRES FROM THE SAME SAMPLE ON DIFFERENT OCCASIONS, URBAN NORTH CAROLINA, 1948 AND 1949[a]

Item	Number	Percent
Total families in sample	255	100
Returned first questionnaire	72	28
Returned second questionnaire	68	27
Returned both questionnaires	41	16
Returned only one questionnaire	58	23
Returned at least one of the questionnaires	99	39

[a] Adapted from data presented by Walter P. Cotton, *Consumption of Dairy Products in Urban North Carolina*, Bulletin 371, North Carolina Agricultural Experiment Station, August 1950, p. 5.

Data presented by Cotton[5] which can be adapted to show similar results, are presented in Table 2. This table shows that while about a 28 percent return was received in both cases, only 16 percent returned both

[5] See Table 2, footnote.

questionnaires, 23 percent returned only one questionnaire, and 39 percent returned at least one of the questionnaires. The most interesting fact is that 35 percent and 23 percent is these two surveys, respectively, returned the questionnaire one of the two times and not the other. This indicates that a large percentage of the families are basically willing to cooperate, and whether they do or not, *will not* depend entirely on the questtionnaire (which was almost identical in both cases) nor on the procedure followed. These families are actually marginal cooperators and may need a little more encouragment. It may simply be the circumstances of their situation at a specific time which causes them to cooperate one time and fail to do so at another. At any rate, it is certain that in the case of most mail questionnaires there exists a fairly large group of marginal cooperators who would probably cooperate under slightly "better" circumstances. It is the surveyor's job to make the circumstances "better."

Two-step follow-up. The fact that the usual return of a mail questionnaire is very low (sometimes as low as one or two percent) indicates that considerable attention ought to be paid to the development and use of better mail techniques. An examination of the reasons why questionnaires are not returned is helpful in this respect. Stonborough,[6] in analyzing the reasons why non-respondents do not return their questionnaires, found the results presented in Table 3.

TABLE 3. ANALYSIS OF WHY NON-RESPONDENTS DO NOT RETURN THEIR QUESTIONNAIRES[a] (U.S. BASIS)

Reason for non-response	Detail	Total
Not interested in the product or subject matter	1.3%	
Don't use the product, etc.	25.7	
Can't understand the questionnaire	3.6	30.6%
Dislike answering questions	7.2	
Say it's none of your business	1.8	
Lost the questionnaire	40.7	49.7%
Say they returned it	14.8	
Say they returned it but would fill in another	3.6	
No answer (cards returned blank)	1.3	19.7%
Total (5,029 cases)		100.0%

[a] Thomas H. W. Stonborough, "Fixed Panels in Consumer Research" *Journal of Marketing*, Vol. VII, No. 2, October 1942, pp. 129–139.

It will be noted that by far the most important single factor was that the questionnaire was lost or misplaced before the potential respondent got around to filling it out. This fact, along with the information in the previous two tables, indicates that one of the most fruitful methods of increas-

[6] See Table 3, footnote.

ing the rate of return of a mail questionnaire would be to follow the original questionnaire with a "one-two punch."

The first follow-up would be a reminder and thank-you note sent out to every addressee in the sample, one or two days after the original questionnaire is mailed. This might consist of nothing more than a two-cent post card with a cleverly written message which would get across the idea that "I want to thank you and congratulate you for your prompt reply, if you have mailed it, and ask you not to forget it if you haven't mailed it." By this immediate reminder greater attention is called to the questionnaire than if the reminder were received a week or two later when the questionnaire had not only been forgotten, but most likely lost or destroyed.

The second follow-up should come after the second week, when the returns are tapering off to a slow trickle. This, however, should include not only a reminder message but also another copy of the questionnaire. The usual procedure in this type of survey appears to be the practice of sending only a reminder card or letter to those who have not returned the questionnaire after a week or more. This procedure fails to take into account the most important reason for not returning the questionnaire (lost or misplaced) and it is not likely to get the results from the large group of marginal cooperators that the double follow-up recommended here would get.

Material incentives. There is often such a great difference in the relative cost of the field work between that of the personal interview and the mail questionnaire that it is profitable to use a monetary or material incentive. When a 100 percent response is desired and all those who do not return the questionnaire by mail are to be contacted by personal interview, it may be profitable to spend a considerable amount of resources in order to get a substantial increase in the rate of mail return. The use of a gift with the mail questionnaire may be the answer.

As early as 1931 Shuttleworth[7] reported: "The enclosure of a twenty-five cent piece in a simple questionnaire sent out by mail brought 51.6 percent replies while the same questionnaire without the coin returned only 19.1 percent replies."

Hancock[8] reports on an experiment using three different incentive techniques with the same questionnaire. These three mail techniques were:

(1) A method of sending out by mail the instrument (questionnaire) with an appropriate letter explaining the purpose of the study and instructions for marking the instrument;

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[7] Frank K. Shuttleworth. "A study of questionnaire technique." *Jour. Educ. Psych.*, Vol. 22, 1931, p. 657.

[8] J. W. Hancock. "An experimental study of four methods of measuring unit costs of obtaining attitudes toward retail stores." *Jour. Applied Psych.*, Vol. 24, 1940, pp. 213-230.

(2) A method of sending out by mail the instrument with the inclusion of twenty-five cents to be kept by the addressee for his efforts used in filling out the instrument. An appropriate letter was also included which explained the purpose of the study, instructions for filling out the instrument, and an explanation for the inclusion of the twenty-five cents;
(3) A method of sending out by mail the instrument with an appropriate letter stating the purpose of the study, instructions for filling out the instrument, and a statement that upon receipt of the filled-out instrument twenty-five cents would be forwarded to the addressee.

The first method (no money or promise) resulted in the return of only 9.56 percent, while the second method (including the $0.25) resulted in the return of 47.2 percent. The third method (a promise of $0.25 upon return of the questionnaire) resulted in a return of 17.6 percent. The effect of the quarter in the letter is obvious. A total of 5,743 letters were mailed in the total survey.

The Woman's Home Companion has made use of the "enclosed quarter" method for numerous polls of its readers. In answer to an inquiry as to the effect of the use of the monetary incentive in these polls Forbes[9] wrote:

. . . You will be interested to know that the enclosure of a twenty-five cent piece in our questionnaire mailings usually results in raising the percent of replies from 20-25 percent to 60-70 percent or better.

Our sole purpose in enclosing a quarter with the questionnaire is to raise the rate of returns. We have found that it usually produces them at a lower cost per questionnaire than mailing without the quarter, while at the same time insuring us a sample which yields much more valid results.

In a Companion poll, the quarter was introduced in the last paragraph of the letter in the following manner: "As a token of appreciation for your help, please accept the enclosed twenty-five cent piece. It is not intended as payment in any way, but is instead of a thank-you letter which I cannot send."[10]

Similarly, Stonborough[11] reports, "Without incentives the response to the average mail questionnaire has varied between 5 and 25 percent of the total mailing, depending upon popular interest. With incentives, a response of from 50 to 90 percent has been achieved every time. Equally important is the additional fact that the rate of response can be controlled through changes in the value of the incentive."

It is evident that the use of a monetary incentive in the mailing of questionaires will materially increase the rate of return in most cases. Whether

[9] Albert G. Forbes, personal correspondence. Mr. Forbes was Research Manager for the Woman's Home Companion.
[10] From letter to a sample polled by the Woman's Home Companion, dated February 9, 1951.
[11] Stonborough, *op. cit.*, pp. 129-139.

or not it will pay in a particular case will depend on the specific circumstances. The failure to make more general use of this method, especially by colleges and agricultural experiment stations, indicates that not enough attention has been paid to the possibilities it presents.

In some situations the monetary enclosure may be an investment in future cooperation. For example, where the non-respondents are to be contacted later by telephone or personal interview, the incentive will not have been wasted if it improves rapport for these future contacts. Similarly, if future participation of respondents is to be sought, such as consumer panel membership, for example, the good will and possible obligation created by the incentive will contribute to this future cooperation.

There are indications that the monetary enclosure has the opposite effect on some people from that desired. They are insulted by being offered the token payment. This was brought home to the authors when a professor in Home Economics expressed indignation on receiving one of the Woman's Home Companion poll questionnaires with the enclosed quarter. Her reaction was to return the money and refuse to answer the questionnaire. This reply was from a usually very cooperative woman who would almost certainly have answered the questionnaire if it had been a simple request for her assistance with no money enclosed. That this is not uncommon is indicated by the fact that in the Hancock[12] survey 8.75 percent of the persons who received questionnaires with money enclosed returned the quarter without completing the questionnaire. This is almost as many as answered the questionnaire without the enclosure. In view of this fact and the desire to save money, someone once suggested sending the first questionnaire without the enclosure of money, following this with a second questionnaire with enclosure to those who did not return the first. This idea bears further investigation.

Mailing "gimmicks." There are a number of other rather simple techniques which may contribute to a greater return rate. It is almost a necessity to include a self-addressed, stamped or business reply envelope in order that the return can be made without expense to the individual being interviewed. The total cost can be reduced by using a business reply envelope, but the cost per returned questionnaire may be lower if a stamp is used. Parten[13] reports that "existing evidence suggests, however, that the percentage of returns is significantly greater (about double) for the regular stamped envelope than for the business reply envelope." Whether or not this is true will, of course, depend on the other circumstances of the survey. For example, Hancock[14] found that from a sample of 119 rural

[12] Hancock, *op. cit.*, p. 220.

[13] Mildred Parten. *Surveys, Polls, and Samples.* Harper and Brothers, New York, 1950, p. 388.

[14] Hancock, *op. cit.*, p. 220.

and 491 urban individuals the comparative cost per unit return by the permit return method was $0.183 as against $0.337 for the stamped envelope return. The evidence is not conclusive on either side—other circumstances of the survey will determine whether or not the stamp will pay. The use of a stamped envelope might raise the return rate from five percent to ten percent but will not raise it from 50 to 100 percent. Other things, such as a letter of transmittal, enclosing an attractive and easily filled-in form, perhaps using colored paper (so that it will attract more attention and not be so easily lost), can contribute to the success of the mail survey.[15]

Personal interview follow-up. When the returns are finally in, large as they may be, the question may still be raised, were the respondents representative of the sample list? This question may be answered by sampling the non-respondents by personal interview. The size of the sample will depend on the degree of accuracy desired and the amount one is willing to pay for the accuracy.[16]

It does not seem necessary to make the personal interview follow-up of non-respondents a part of every mail survey. Certainly there are many types of data which are not subjected to non-response bias. Some of these are indicated in this study. Also, where the non-response bias is small and the objective of the survey is to obtain broad over-all averages, a high response rate will provide highly valid results, and no follow-up is necessary.

In order to determine the nature of the non-response bias of the mail survey, a personal interview follow-up may be necessary. It is only in this way that a fund of knowledge on this subject can be economically accumulated.[17] It is with this in mind that the following empirical study is reported.

An Empirical Study

The sample for this study was selected from the address section of a current city directory. In this section of the directory, streets are listed alphabetically and addresses are in numerical order under each street.

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[15] Consideration might well be given to the stamp and envelope used in sending out the questionnaire. With the large amount of mail advertising reaching most people these days, it is preferable to distinguish the questionnaire from advertising copy. The first requirement is that the mail be opened. A commemoration stamp might help to attract attention.

[16] If nearly 100 percent return is desired, all of those not responding to the mail questionnaire could be contacted by personal interviewer. The cost of many surveys could be reduced substantially by first attempting to get the information by mail and using the personal interview (or perhaps even the telephone) for those who do not respond to the mail questionnaire.

[17] See Earl E. Houseman, "Statistical Treatment of the Nonresponse Problem" in *Agricultural Economics Research*, Vol. V, No. 1, p. 12 ff.

The name of the resident is listed with each address. The sample was drawn systematically from this list by taking every 15th residential address after a random start. This yielded the desired sample of 4,410 families.

Over 35 percent of the questionnaires mailed were returned. This was a fairly large return considering that no incentive was used, and only one follow-up was mailed.

The questionnaire was worded in such a manner that it was easy to fill out and interesting to answer. Furthermore, the questionnaire was arranged so that it was applicable to all addresses. Much time was spent in preparing and pretesting the questionnaire. An introductory letter accompanied each questionnaire. This letter explained simply the purpose of the study and how much the success of the study depended on each addressee. Everyone who had not replied within a five-day period was sent a two-cent post card reminder.

These post card reminders appear to be one of the most important reasons for the good response. One week after the post card reminders were mailed, the number of replies received showed a large increase. That increase could be related only to the reminder the post cards contained. The total time allowed for the questionnaires to be answered and returned was five weeks.

Alternate questionnaires were addressed simply to Occupant of the address selected, while the names of the families as listed in the city directory were used for the other half of the sample in order to determine the relative response rates of these two procedures. The returns between those who were addressed by name and those addressed to Occupant varied significantly when using the t-test. There was a better response when an envelope was addressed to, say, Mr. Howard Ball, 2518 Can Avenue, than when addressed to Occupant, 2518 Can Avenue. The "names" returned 55 percent of the total returns, the "occupants" 45 percent. Eight questionnaires were returned with the code torn out of the questionnaire, making it impossible to identify them as either "name" or "occupant." This points up the importance of concealing the code if it is of extreme value.

Again, there is no accurate method of determining the reasons why the response varied between names and occupants. It is the writers' belief that numerous people answered the questionnaire because they wanted to contribute something and feel important. Therefore, when questions were asked directly of "Mrs. Moore" and "Mrs. Black," it aroused more of a feeling of importance from them than when questions were directed in an impersonal form.

A second reason for the difference may have been that the "occupant" reminder cards did not always reach the same person who had received

the questionnaire earlier. If there were two families living in a building, it was possible for one family to receive the questionnaire and another family to receive the post card, nullifying the reminder effect of the post card.

Are the respondents to a mail survey different from or similar to the non-respondents? To answer this question a sample of the non-respondents in the mail survey mentioned above was drawn. This sample of non-respondents was personally interviewed and was asked to answer the same questions that were in the original questionnaire sent via the mails.

The sample of non-respondents which was personally interviewed was comprised of 245 households. This sample was drawn using a random start, then drawing every *n*th non-respondent. The size of the sample was set by the budget. Because families move, take vacations, visit, die and sometimes refuse to answer interviewers' questions, an "alternate household" was randomly chosen for each of the 245 "original households."

A group of young married women was employed to conduct the personal interviews. This was a church group and the interviewing proceeds were donated to the church. The arrangements were for the interviewers to call upon the original household twice, unless they learned from a neighbor on the first visit that the family had either moved or for some other reason could not be contacted. Then they were to call at least twice upon the alternate household. If the original household either refused or could not be contacted and the same was true for the alternate household, the sample was reduced by one family. The minimum number of calls the interviewers could make was the number in the sample, 245. The maximum number of calls was 980, two at the Number One household and two at the Number Two or alternate household. The contract price for the job was $300.

Two training meetings were held with the interviewers. At the first meeting the interviewers were told the purpose of the survey and how it was to be conducted. The mail questionnaire was reworded somewhat for the personal interview and a few additional questions were added relating to why the mail questionnaire was not returned. One week later the second training meeting was held. At this meeting all questions relating to interpretation of questions and the interview technique were answered.

There were 192 completed questionnaires obtained from the interviews. There were 401 calls made or an average of 2.1 calls per completed questionnaire. There were 209 unproductive calls. Of a total of 298 calls made at original households, 143 were productive. Of a total of 103 calls made at alternate households, 49 were productive.

Table 4 shows why the interviewers were not able to turn back completed questionnaires for all of the sample. The most common reason why the questionnaires were not completed was that the families were

not at home. This was true despite the fact that the neighbors were asked when the families in the sample would be at home. About one-fourth of the 209 unproductive calls were due to the fact that the families had moved or there was a wrong address given for them. The city directory which was used for drawing the sample was one year old. Five of the 209 families had been dissolved because of death in the family and another five said the original questionnaire had been mailed in. Only 9 percent of the original mail sample was returned unclaimed. Postal authorities and new tenants do forward mail. This is a definitive advantage to mail surveys.

TABLE 4. REASONS WHY PERSONAL INTERVIEW QUESTIONNAIRES WERE NOT COMPLETED

Reason	Number	Percent
1. Not at home	101	48.1
2. Moved from address	40	18.9
3. Wrong address	14	6.6
4. Refused because:		
a. No reason	21	10.4
b. Personal dislike of questionnaire	8	4.2
c. Used little meat	5	2.4
d. Mailed questionnaire in	5	2.4
e. Personal illness	2	.9
5. Miscellaneous:		
a. Deceased	5	2.3
b. Impossible (place of business, priest, parish)	2	.9
c. Language difficulties	4	1.9
d. Will answer if mailed another form	1	.5
e. Interviewer refused to enter yard of addressee	1	.5
Total	209	100.0

The answers which were given on the 192 completed questionnaires were compared with answers which had been given on the questionnaires sent in by mail. Two statistical tests were used to compare these answers: the t-test, mentioned above, and the Chi-square (X^2) test. Table 5 shows the results of the comparisons of the sample responses.

The empirical study reported here was designed to investigate consumer reaction to prepackaged fresh meat. The usual socio-economic factors were compared to learn their effect on meat buying habits. The reader can see in Table 5 that the mail respondents and non-respondents were not different when size of family, age of homemaker, family food expenditure, family member buying meat, frequency of meat purchase, and how meat was stored in the home were compared. These two groups were different when education, income, mode of travel used to shop for meat, and attitude toward and the purchase of prepackaged meat were compared.

This study showed that in general the younger homemakers with above

average income comprised the group that preferred prepackaged meat. Two types of bias were demonstrated in this study.[18] The first was an education bias. The less literate did not return as high a percentage of the mail questionnaires as the literate. Directly associated with education was income, and consequently automobile ownership. The higher income families did most of their food shopping by automobile. Therefore, the mode of travel was significantly different between the lower income

TABLE 5. COMPARISON OF RESULTS FROM A MAIL SURVEY WITH RESULTS OBTAINED BY PERSONALLY INTERVIEWING A SAMPLE OF THE MAIL NON-RESPONDENTS, GRAND RAPIDS, MICHIGAN

Question Asked	Comparison of Sample Responses
1. Number in household?	Not significantly different
2. How often buy meat?	Not significantly different
3. How store meat at home?	Not significantly different
4. Amount spent for week's food supply?	Not significantly different
5. Family member who buys meat?	Not significantly different
6. Age of homemaker?	Not significantly different[a]
7. Amount of weekly family income?	Significantly different[b]
8. Mode of travel used to shop for meat?	Significantly different[c]
9. Education of homemaker?	Significantly different[c]
10. Ever bought prepackaged meat?	Significantly different
11. How prefer to buy fresh meat?	Significantly different
12. Percentage of meat bought prepacked?	Significantly different

[a] The X^2 test was not significant. The t-test showed that homemakers in the interview bought a significantly larger percentage of meat than did the homemakers in the mail survey. There was no difference statistically in the two samples in the proportion other family members bought.

[b] The 5 percent level of significance was used, unless otherwise specified.

[c] The X^2 test was significant at the 1 percent level.

families—the non-respondents to the mail survey—and the higher income families.

The second type of bias was the interest bias. Those families who had used prepackaged meat knew quite a bit about it and showed more interest than those who had never tried it. It seemed only natural that the group which had tried prepackaged meat would be more apt to prefer it than would the group which had not tried it.

Biases can be corrected or eliminated by interviewing all of the non-respondents or by contacting a sample of the non-respondents through personal interview or telephone and developing correction factors. So, even if biases are present, a mail survey can be used with a correction factor employed. Much of the bias could be eliminated by limiting studies

[18] Experience has shown that certain types of bias, due to non-response, can be corrected. For example, the Federal Crop Reporting Service adjusts for bias.

to those families or individuals who had "associated with the thing being studied."

We have presented our thesis that "good" data can be obtained by using the mail survey technique. Less expense is usually involved in obtaining data by mail than by personal interview.

In the study reported here, each completed schedule cost $0.39 in the mail survey. Each completed schedule in the personal interview survey cost $1.82. In a study made in Detroit, Michigan, in 1949 each completed

TABLE 6. COSTS INVOLVED IN OBTAINING 1534 COMPLETED SCHEDULES IN A MAIL SURVEY

Item	Total Cost	Per-schedule Cost
Paper—mimeograph	$ 42.	$.027
Envelopes—regular and business reply	70.	.046
Postage—outgoing and return	203.	.132
Post cards—reminder post cards	92.	.060
Labor—office labor . . . typing, etc.	150.	.098
City directory	35.	.023
Total	$592.	$.386

schedule cost $0.54 in a mail survey. Each completed schedule cost $2.72 in the personal interview.[19]

The costs of $0.39 and $1.82 in this study do not include the cost of editing, coding and analyzing. Only the costs involved in obtaining the completed schedules and getting them "back in the office" are included. Table 6 shows the costs included in the per-schedule cost in the mail

TABLE 7. COSTS INVOLVED IN OBTAINING 192 COMPLETED SCHEDULES IN A PERSONAL INTERVIEW SURVEY OF MAIL NON-RESPONDENTS

Item	Total Cost	Per-schedule Cost
Labor—personal interviewing	$300.	$1.56
Labor—office . . . typing, etc.	10.	.05
Paper—mimeograph	3.	.02
Travel—to conduct training meetings, etc.	36.	.19
Total	$349.	$1.82

survey. Table 7 shows the costs included in the per-schedule cost in the personal interview survey.

[19] Marco A. Baeza. "Sampling and response differences for three methods of enumeration obtained in a study of consumer potato preferences." Thesis for degree of Ph.D., Michigan State College, East Lansing. (Unpublished)

Summary

The purpose of this paper was to point out some of the advantages and disadvantages of the mail survey, and, where possible, to indicate means of eliminating or minimizing the disadvantages. One of the major advantages of the mail survey is the large potential savings in survey costs. The major disadvantage of the mail survey is the possibility of bias due to non-response. In order to realize the advantage of low cost and minimize the non-response bias, it is necessary to conduct the survey in such a way as to stimulate a high rate of return. Evidence shows that a large number of people are actually marginal cooperators and one of the main reasons why they do not return a questionnaire is that they simply forget or lose the questionnaire before "getting around to it." A well-timed and persistent follow-up program will result in many additional questionnaires being returned. Meticulous attention to the many details, such as questionnaire design, pretesting, the use of colored questionnaires, return envelopes, and design of the cover letter probably spell the difference between success and failure in a mail survey. It was also suggested that too little use has been made of material incentives as a device for encouraging high response rates.

The possibility of using a follow-up sample of non-respondents as a check for non-response bias was discussed. An analysis of such a follow-up sample was presented. This empirical study indicated that the mail survey is biased with respect to education of respondents and interest in the survey topic. No evidence of bias was found which was not related to these. Thus, for many surveys the mail survey will present no serious non-response bias. For others a bias may be present but may be discovered by subsequent sampling of non-respondents.

Other advantages of the mail survey are the wide geographic distribution which is possible, the ability to reach specific classes of people otherwise relatively inaccessible, the elimination of interviewer bias, and the possibility of obtaining more honest replies than with the short-answer type of personal interview.

Like all other survey techniques the mail survey has its disadvantages and limitations. However, if used properly it has the potential to deliver quick, inexpensive and reliable results.

EFFECTS OF CHANGES IN PRICES, INPUTS AND EFFICIENCY ON FARM INCOMES (1937-39 TO 1948-50)

JAMES VERMEER
Agricultural Research Service

LARGER net farm incomes in the last several years compared with those of the late thirties are often attributed solely to the higher prices received for farm products. These higher prices have been an important factor although they have been partly offset by the higher prices paid for items used in production. But in addition to higher prices, the use of more resources and the greater efficiency in production also have contributed significantly to higher incomes.

For farmers, as a group, changes in volume of production are associated with a tendency for prices of their commodities to move in the opposite direction. However, the relationship of volume and price is not the same for all farmers, but varies with the elasticity of demand for their respective products. For farmers as individual producers there is little, if any, relationship between volume of production and price, except that they may plan their level of production in anticipation of a given set of prices at some later date. Since this analysis is concerned with the effects of these and other factors on individual farms of different types the relationship between volume and price may be ignored.

Most farmers have benefited from the increase in the price level during the decade of the 1940's, but not all of them have profited by recent technological changes. Some have adopted new techniques which have raised the "level of farming" but have added little to production. Some farmers have been unable to discard older techniques in order to reduce costs.

This paper attempts to segregate the effects on net incomes of several types of farms of (1) changes in the price level, (2) changes in the quantity of inputs, and (3) changes in efficiency.

These changes have occurred simultaneously. As a result, the effects of any one of them on farm incomes are obscured by the presence of the other two. It is possible to estimate the effects of each of these factors. But before looking at the effects on net farm income, it will be helpful to look at the changes that occurred during a recent 10-year period, in prices, quantity of resources used, and efficiency. Increased efficiency, as used in this paper, results from a combination of use of new techniques and of increasing the inputs of the limiting factor or factors so that other factors are employed at more nearly optimum capacity. By this definition efficiency includes only changes which are made within the farm. In other words, any change in efficiencies outside of the farm may be reflected in

the prices paid or received by farmers but do not affect efficiency in farm operations. It is measured as the change in total production (or output) per unit of input of all factors.

To measure these changes, two periods are used as bases for comparison –the averages of the years 1937-39 and 1948-50. The years 1937-39 represent a period of relatively stable production. They exclude the worst years of the depression and drought, and they were affected very little, if any, by the inflationary effects of World War II. The years 1948-50 represent 3 postwar years of fairly stable production and prices. Demand for farm products was strong but goods used in production were relatively plentiful. Labor shortages were not serious so that, generally, a free choice of

TABLE 1. PRICES RECEIVED AND PRICES PAID BY FARMERS, SELECTED TYPES OF FAMILY-OPERATED FARMS, 1948–50 AVERAGE

(Index numbers 1937–39 = 100)

Type of Farm	Prices Received	Prices Paid[a]
Central Northeast dairy	247	198
Corn Belt hog-beef fattening	264	246
Spring wheat-small grain-livestock	291	200
Black Prairie cotton	324	237
Intermountain Cattle	321	198

[a] Items used in production, including hired labor.

resources was available to produce goods to meet this greater demand.

From 1937-39 to 1948-50 prices received by farmers in this country rose 152 percent while prices paid rose 105 percent. Because the products sold differ from one type of farm to another and the items used in production differ also the changes in prices paid and received by individual farmers seldom are equal to the national average. Indexes of prices received and paid are shown in Table 1 for 5 types of farms.

The change in quantity of resources used in production, or inputs, also differ among types of farms, and on some farms inputs have increased faster than production so that efficiency has gone down. Table 2 shows the changes in volume of input and production per unit of input for 5 types of farms.

One point which should not be overlooked in appraising relative changes in efficiency on different types of farms is that in the base period considered here (1937-39) these farms were not all at the same level of efficiency. Wheat farms were already highly mechanized. The Corn Belt farms were well started into a period of increasing efficiency, largely through the use of hybrid seed corn and mechanization. Except for the use of tractors for a few tillage operations on some farms, production techniques on Black Prairie cotton farms were still in the hand and mule labor

TABLE 2. TOTAL INPUTS AND PRODUCTION PER UNIT OF INPUT, SELECTED TYPES OF FAMILY-OPERATED FARMS, 1948–50 AVERAGE

(Index numbers 1937–39 = 100)

Type of Farm	Total Input[a]	Production per Unit of Input
Central Northeast dairy	125	104
Corn Belt hog-beef fattening	145	112
Spring wheat-small grain-livestock	143	153
Black Prairie cotton	127	94
Intermountain cattle	110	100

[a] This index is the average of inputs computed at 1937–39 prices and at 1947–49 prices. Because of the shift in the proportion of factors used in production and a differential rate of change of factor prices, a measure of the change in inputs at any one price level would be somewhat misleading, as illustrated in the following tabulation:

Type of farm	Change in inputs from 1937–39 to 1948–50 measured in terms of:	
	1937–39 prices *Percent*	1947–49 prices[a] *Percent*
Central Northeast dairy	+28	+23
Corn Belt hog-beef fattening	+49	+40
Spring wheat-small grain-livestock	+54	+32
Black Prairie cotton	+29	+24
Intermountain cattle	+11	+ 6

[a] 1947–49 instead of 1948–50 prices are used in this illustration because inputs at these prices were already computed for another purpose.

As the widest range appears to be in the estimate of inputs on spring wheat-small grain-livestock farms, a look at the composition of inputs in the two periods with different price weights is revealing.

Input item	Percentage of total inputs at:		
	1937–39 av. prices		1947–49 prices in 1948–50
	in 1937–39	in 1948–50	
All labor	32	19	36
Land and buildings[a]	21	18	13
Machinery operation and depreciation	31	46	35
Working capital	7	10	10
All other	9	7	6
Total	100	100	100

[a] Repairs and depreciation on improvements included with "all other" inputs.

Columns 1 and 2 of this tabulation show the change in composition of inputs in the two periods when constant (1937–39) prices are used. Machinery has become more important and labor, land, and working capital have become less important. However, the relative importance of each class of inputs differs when measured in terms of 1947–49 prices. At these prices labor constitutes a much larger part of total inputs than at 1937–39 prices (36 compared with 19 percent). During the 10-year period considered here wage rates rose nearly fourfold while land charges and cost per unit for operation and depreciation of machinery increased by only a little more than half.

era. Today these farms are generally "tractorized," but they still have some distance to go to become fully "mechanized." Methods used in producing livestock, particularly cattle, have not benefited greatly by the surge of technical progress which has brought about such greatly increased efficiency in the production of many kinds of crops. As a result, efficiency in production of the main enterprise on livestock ranches remained almost unchanged.

Briefly these are the factors—higher prices, improved efficiency, and greater production per farm—which as seen in isolation have contributed to higher incomes on farms. When they occur simultaneously on the same farm their effects are multiplied. Net incomes rose considerably from 1937-39 to 1948-50 on most types of farms. On some types of farms these higher incomes were the result of a higher price level combined with greater production through greatly increased efficiency. On others higher net cash incomes were caused by higher prices and greater production, but with the increase in production obtained largely by the use of more resources. On still others it was the result of higher prices only, or higher prices and despite lower production efficiency.

Measuring the Change in Net Farm Income Due to Changes in Prices, Inputs and Efficiency

One way to measure the change in net income from 1937-39 to 1948-50 due solely to higher prices (received and paid) is to compare average net farm incomes in 1937-39 with what net farm incomes would have been if 1937-39 production had been achieved at 1948-50 prices. Likewise, the change in net income during the same period due solely to changes in production and efficiency can be measured by comparing 1937-39 average net income with what it would have been if production in 1948-50 had been achieved at 1937-39 prices. However, this method leaves a considerable area of interaction due to change in both prices and production. Furthermore, it does not measure the change in net income due to changes in inputs and efficiency.

The separate effects of changes in prices, inputs and efficiency on the change in net income can be measured by first determining the effect of each of these factors on gross income and on operating expenses, and then subtracting the additional (or lowered) cost due to each factor from the additional (or lowered) gross income due to the same factor. Income and expenses on Northeast dairy farms are used to illustrate the method in the discussion which follows.

The average gross income, operating expense and net income in 1937-39 and 1948-50 and the change between the two periods for central Northeast dairy farms are shown in Table 3.

Gross income may be defined as the product of production × prices received. Likewise, production may be defined as the product of total inputs × efficiency in the use of those inputs. Therefore, gross income is the product of total input × efficiency × prices received.[1] If each of these factors is given a value of 1.0 in the base period (1937-39) gross income in

TABLE 3. GROSS INCOME, OPERATING EXPENSE, AND NET INCOME, CENTRAL NORTHEAST DAIRY FARMS, 1937–39 AND 1948–50

Item	1937–39 average	1948–50 average	Change from 1937–39 to 1948–50	1948–50 as % of 1937–39
	Dollars	*Dollars*	*Dollars*	
Gross income[a]	2,752	8,928	6,176	324.4
Operating expenses	1,991	5,106	3,115	256.0
Net income[a]	761	3,822	3,061	502.2

[a] Excludes government payments.

the base period becomes 1.0 × 1.0 × 1.0. Likewise, the value of each factor in 1948-50 may be expressed as a ratio to the value in 1937-39. Then gross income in 1948-50 becomes 1.254 × 1.045 × 2.474 = 3.242. (These factors are from Tables 1 and 2, expressed as ratios instead of percents and carried out to the third decimal.) Expressed as a percent of the base this is equal to 324.2 percent of gross income in the base period. Except for a slight difference due to rounding numbers and perhaps some skewing in the construction of the ratios and indexes, this is equal to the index of gross income shown in Table 3.

TABLE 4. RATIOS OF CHANGES IN PRICES RECEIVED, TOTAL INPUTS AND EFFICIENCY, CENTRAL NORTHEAST DAIRY FARMS, 1937–39 TO 1948–50

Item	Value or level		Change in value or level from 1937–39 to 1948–50	Average of value or level 1937–39 and 1948–50
	1937–39 average	1948–50 average		
Prices received	1.000	2.474	1.474	1.737
Total inputs	1.000	1.254	.254	1.127
Efficiency	1.000	1.045	.045	1.0225

The rate of change in gross income due to a change in one factor can be measured by multiplying the change in that factor times the product of the average value of the others.

For example, the change in prices received from 1937-39 to 1948-50, as shown in Table 4 (2.474 − 1.000) is equal to 1.474 times the price level in

[1] All income influencing effects are by definition included in one or the other of these three factors.

1937-39. The average value of total inputs during the period 1937-39 to 1948-50 is $\frac{1.000 + 1.254}{2} = 1.127$. Similarly the average level of efficiency in this period was 1.0225. The product of these 3 factors, $1.474 \times 1.127 \times 1.0225 = 1.699$. In other words, gross income in 1948-50 is 1.699 times what it was in 1937-39 ($2,752) because of the change in prices received.

TABLE 5. CHANGE IN GROSS INCOME DUE TO CHANGES IN PRICES RECEIVED, TOTAL INPUTS AND EFFICIENCIES, CENTRAL NORTHEAST DAIRY FARMS, 1937-39 TO 1948-50

Item	Rate of change	Average value or level	Rate of change in gross income due to item	Change in gross income due to item	
				Computed	Adjusted
Prices received	+1.474	1.737	1.699	$4,676	$4,688
Total inputs	.254	1.127	.451	1,241	1,245
Efficiency	.045	1.0225	.088	242	243
				$6,159	$6,176

Changes in gross income due to changes in total inputs and in efficiency can be computed in a similar manner. The values obtained from these computations are shown in the third column of Table 5. The change in gross income is shown in column 4. In column 5 these changes have been adjusted proportionately so that the total of the 3 is equal to the total change in gross income as shown in Table 3.

The method used to measure the change in operating expenses due to changes in prices paid and in quantity of inputs is similar to the method

TABLE 6. CHANGE IN OPERATING EXPENSES DUE TO CHANGES IN THE LEVEL OF PRICES PAID AND IN THE QUANTITY OF CASH INPUTS, CENTRAL NORTHEAST DAIRY FARMS, 1937-39 to 1948-50

Item	Rate of change	Average value or level	Rate of change in operating expense due to item	Change in operating expense due to item
Prices paid	+0.978	1.489	1.123	$2,235
Cash inputs	.297	1.1485	.442	880
				$3,115

used to measure effects of the various factors on gross income. Table 6 shows the changes in operating expense attributable to each factor.

Efficiency in the use of inputs affects only production and indirectly affects gross income but it has no effect on operating expenses. That is, more (or less) efficient use of a given quantity of inputs at a given cost affects output but it does not alter the cost of those inputs. However, the

price level and quantity of inputs affect both gross income and operating expense, and they have opposing effects on net income. Therefore, the increase in gross income due, for example, to higher prices is offset to a

TABLE 7. CHANGE IN NET INCOME DUE TO CHANGE IN THE PRICE LEVEL, TOTAL INPUTS, AND EFFICIENCY, CENTRAL NORTHEAST DAIRY FARMS, 1937–39 TO 1948–50

Item	Change due to:			Total change
	Price	Input	Efficiency	
Change in gross income[a]	$+4,688	$1,245	$243	$6,176
Change in operating expenses	2,235	880	—	3,115
Change in net income:[a]				
Dollars	2,453	365	243	3,061
Percent of total	80	12	8	100

[a] Excluding government payments.

considerable extent by a similar increase in operating expense. The net effect of each factor is shown in Table 7.

The change in net income due to changes in prices, inputs and efficiency for 4 other types of farms also was computed in the same manner. The proportion of the change due to each factor is shown in Table 8.

TABLE 8. CHANGE IN NET FARM INCOME (EXCLUDING GOVERNMENT PAYMENTS) CAUSED BY CHANGES IN PRICE LEVEL, INPUTS AND EFFICIENCY, SELECTED TYPES OF FARMS, 1937–39 TO 1948–50

Type of farm	Change in net farm income	Change in net farm income caused by change in:		
		Price level	Inputs	Efficiency
	Dollars	*Percent*	*Percent*	*Percent*
Central Northeast dairy	3,061	80	12	8
Corn Belt hog-beef fattening	8,384	66	18	16
Spring wheat-small grain-livestock	5,081	55	6	39
Black Prairie cotton	2,293	105	4	−9
Intermountain cattle	6,835	97	2	1

Significance of Proportion of Change in Net Income Due to Each Factor

On northeastern dairy farms and hog-beef fattening farms in the Corn Belt about four-fifths and two-thirds, respectively, of the increase in net income was due to higher prices. These farms were operating at a fairly high level of production during the 1937-39 period so that the higher prices affected a large volume of production at the 1937-39 level of operation in addition to their effects on the additional inputs and productions. Both the levels of inputs and production were significantly higher in 1948-50 but not without a considerable increase in costs so that their effect

on changes in net income was relatively small. On hog-beef fattening farms, however, increased inputs and efficiency accounted for fully a third of the higher net income despite a high level of production in 1937-39.

In the 1937-39 period production on the spring wheat farms was less than half of what it was 10 years later. A large part of the increased production since 1937-39 was due to higher yields resulting from more favorable weather. Also, more land, more machinery, and more timely operations have contributed to the greater production. Consequently, the increase in net income due solely to the change in the level of prices represented only slightly more than half of the total increase in net income. Nearly two-fifths of the higher net income was due to greater efficiency—largely higher crop yields. Size of farm also increased so that gross income was higher, but this increase was largely offset by higher costs.

Conditions on Black Prairie cotton farms and Intermountain cattle ranches were quite different from those on the first 3 types of farms discussed. Production was relatively high in the 1937-39 period, and it increased some during the next decade. But operating expenses in terms of real costs (excluding price changes) rose as fast or faster than production. Consequently, except for the higher price level net incomes would have been about the same or lower than in the 1937-39 period. In other words, if prices had remained at the 1937-39 level these farmers would not have raised their net incomes by the changes which were made in their operations between 1937-39 and 1948-50.

The effects of changes in price level, efficiency and volume of production varied widely on these 5 types of farms. Expenses include only those on owner-operated farms. Rent and interest payments are excluded. The effects on individual farms will vary from those shown in the above illustrations depending upon rent and interest paid as well as differences in the nature and volume of production, prices received and paid and efficiency.

Effects of Price Level on Capital Charge and Cost of Living

At least two other elements have some effect on the contribution of the higher price level to higher net incomes. One is the effect of price change on the cost of capital invested in the farm. The other is the effect of price change on the cost of living of farm families and consequently on the purchasing power of the net farm income.

The effect of higher capital requirements is shown in Table 9. In this table net farm income has been adjusted for change in the cost of capital. Furthermore, it is assumed that the higher charge for capital is due entirely to the higher price level, whereas, in fact, some of the higher charge for capital is due to a larger volume of physical assets but the difference is small. A comparison of Table 9 with Table 8 shows the difference in the

contribution of price level, volume and efficiency when the higher cost of capital in the 1948-50 period is deducted from the contribution of "price" in Table 9 and when it is omitted from consideration as in Table 8.

From 1937-39 to 1948-50 the index of prices paid for items used in family living doubled. It may be argued that this is due entirely to the

TABLE 9. CHANGE IN NET RETURN TO OPERATOR AND FAMILY, CAUSED BY CHANGES IN PRICE LEVEL, INPUTS AND EFFICIENCY, SELECTED TYPES OF FARMS, 1937–39 TO 1948–50

Type of farm	Change in return to operator and family[a]	Percent of change in return to operator and family caused by change in:		
		Price level	Inputs	Efficiency
	Dollars	*Percent*	*Percent*	*Percent*
Central Northeast dairy	2,438	75	15	10
Corn Belt hog-beef fattening	6,971	60	20	19
Spring wheat-small grain-livestock	3,985	42	8	50
Black Prairie cotton	1,803	107	5	−12
Intermountain cattle	5,079	96	3	1

[a] Excluding government payments.

higher price level and therefore the added cost should be charged against the contribution of price to the higher net income. For example, the net farm income on central Northeast dairy farms averaged $761 in the 1937-39 period (see Table 3). Since the price of things farm families use in family

TABLE 10. CHANGE IN NET FARM INCOME (ADJUSTED FOR CHANGE IN PURCHASING POWER OF 1937–39 NET FARM INCOME) CAUSED BY CHANGES IN PRICE LEVEL, INPUTS AND EFFICIENCY, SELECTED TYPES OF FARMS, 1937–39 TO 1948–50

Type of farm	Change in net farm income[a]	Percent of change in net farm income caused by change in:		
		Price level	Inputs	Efficiency
	Dollars	*Percent*	*Percent*	*Percent*
Central Northeast dairy	2,300	74	16	10
Corn Belt hog-beef fattening	6,075	54	24	22
Spring wheat-small grain-livestock	4,937	53	7	40
Black Prairie cotton	1,551	108	6	−14
Intermountain cattle	4,686	96	3	1

[a] Excludes government payments.

living doubled by 1948-50 net income would have to be at least twice the 1937-39 average, or $1,522 before there would be any increase in "real" net income. Subtracting $1,522 from the 1948-50 average net income of $3,822 leaves the $2,300 shown in Table 10. Furthermore, instead of a contribution of $2,453 due to the higher price level, as shown in Table 7, the con-

tribution is only $1,692 ($2,453 less $761). This $1,692 is 74 percent of the change in net income after adjusting it to allow for the higher prices of things farmers buy for family living.

Therefore, whether the cost of capital is included or excluded the higher price level of the latter period still accounts for 75 to 80 percent of the higher net farm income on central Northeast dairy farms. Similarly, adjusting net income for the higher cost of living has no appreciable effect upon the proportion of the higher net income due to the higher price level. Similar comparisons for other types of farms show the effects of these adjustments. The difference in the proportion contributed by price level is greatest on spring wheat farms where the proportion contributed by the higher price level is the smallest of the five types of farms included in this study.

ON THE ECONOMICS OF GROUND-WATER MINING—A CASE STUDY IN AN ARID AREA*

J. Herbert Snyder**
University of California

THE Antelope Valley, located in the western Mojave Desert of southern California, is mainly dependent on ground water. The value of all crop production for the area in 1953 exceeded $10,000,000, more than 87 percent of which was accounted for by irrigated crops. The Valley is subject to serious overdraft.[1] A consequent decline in ground-water levels of nearly fifty feet in the last twelve years has created concern in Antelope Valley and other areas with similar ground-water conditions. The Agricultural Research Study Committee of the California Legislature has stressed the need for study of these and related problems and the Giannini Foundation of Agricultural Economics has begun studies that emphasize the economic aspects of ground-water problems[2] This paper presents a portion of the findings of one of them—the Antelope Valley study—the factors that influence pumping costs and the relation between pumping costs and enterprise selection, together with an evaluation of some of the barriers to ground-water conservation.

What Has Been Mined?

Water resources of the Valley include rainfall on the Valley floor, surface stream diversions, and water pumped from the ground-water reservoir, but the bulk of irrigation water used is taken from ground water. The Valley alluvium receives, absorbs, and stores most of the seasonal runoff from precipitation in the surrounding mountains. In the past, streams entering the Valley filled the entire basin more or less to capacity, after which the volume stored did not vary significantly with time until man started to use it. It is estimated that at the time of initial agricultural development in the Valley this ground-water stock resource, to a 500-foot depth (representing the approximate economic limits of pumping), was about 10,000,000 acre-feet.[3]

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* Giannini Foundation Paper No. 139, based on J. Herbert Snyder, "Factors Affecting the Ground-Water Economy of the Antelope Valley, Los Angeles County, California." Unpublished doctoral dissertation, University of California, Berkeley, 1953.

** The author is indebted to Professors S. V. Ciriacy-Wantrup and R. G. Bressler for their constructive help during the development of this paper.

[1] Overdraft is the volume of ground water removed in excess of recharge within a particular area and for a specified time period.

[2] P. M. Bartz, *Ground Water in California, The Present State of Our Knowledge.* Giannini Foundation Ground Water Studies No. 1. Second Edition. Berkeley, California, February, 1950. (Foreword by S. V. Ciriacy-Wantrup) p. i.

[3] The ground-water resource has been divided into two components: (1) The flow component or annual recharge volume makes available for use different units of the

Annual ground-water recharge (volume of inflow entering ground-water storage each year) is subject to great variation, with some quantity available each year. This ground-water flow resource is estimated to average 40,000 acre-feet per year. This flow resource, by itself, would be sufficient to maintain an annual average of about 8,000 acres of alfalfa in the Valley. In 1953 alfalfa acreage approximated 42,000 acres with an additional 15,000 acres in a wide variety of irrigated fruit, field, and vegetable crops.[4] Contrasting this agricultural scene with urban water requirements it may be stated that this same flow resource would be sufficient to maintain a population between 90,000 and 150,000 persons depending upon the type and extent of industrial development. The 1953 population of the Valley was estimated at 26,000.

Comparing characteristics and magnitudes of the flow and stock component of the ground-water resource, a most important physical fact is revealed: a small, highly variable flow resource has created a large stock resource that can be mined to provide water for agricultural and other uses.

The Impact of Mining the Ground-Water Resource

Ground-water draft is the removal of ground water from storage by man for his use. Net draft on ground water was estimated from electrical power consumption data for the period 1924 to 1951 inclusive.[5] Price levels, crop acreages, and draft are interrelated through variations in price levels causing variations in crop acreages and draft. Departures from this relationship point to further influence on ground-water draft by climate. From 1924

resource in different intervals of time. This component may be used indefinitely provided the flow continues, is subject to variation, and, in any one year, has no effect upon the flow in future years. (2) The stock (stored flow) component is the water contained in the ground-water reservoir that, until man started to use it, did not vary in volume to any significant degree. See: S. V. Ciriacy-Wantrup, *Resource Conservation Economics and Policies*. University of California press, Berkeley, 1952. pp. 35-38.

[4] Alfalfa has remained the most important crop in the area in terms of acreage as well as gross income.

IRRIGATED ACREAGE STATISTICS FOR ANTELOPE VALLEY ALFALFA AND ALL CROPS, 1910–1953, BY DECADES

Period	Maximum irrigated acreage		Minimum irrigated acreage	
	Alfalfa	All crops	Alfalfa	All crops
	Acres			
1910–1919	7,200	12,000	2,500	3,500
1920–1929	25,000	31,500	7,000	12,500
1930–1939	23,000	30,000	17,000	24,000
1940–1949	39,000	52,000	24,000	32,000
1950–	42,000	57,000	39,000	52,000

to 1951 the estimated net draft in Antelope Valley (volume of ground water permanently removed from storage) increased from 27,000 to 166,000 acre-feet per year. Marked decreases during the depression of the 1930's interrupted an otherwise continual increase. Reductions from anticipated annual draft were observed during years of extra-heavy precipitation, and large increases appeared during drought periods.

Economic forces discussed below have stimulated ground-water mining —i.e., annual draft rates on ground water beyond the safe yield level— creating overdraft and declines in ground-water levels. The ground-water flow resource or recharge volume of a ground-water basin, expressed as an annual average, is equivalent to the physically determined safe yield of that basin. It represents the amount of water that may be withdrawn from ground-water storage indefinitely for man's use without significantly affecting the character or volume of the reservoir. Safe yield draft rates, merely to preserve the physical character of the resource, do not automatically become a policy goal of ground-water utilization programs.

Comparison of recharge and draft estimates for 1924-1953 reveals that only in 5 of the 28 years did recharge exceed draft. Long-run (secular) overdraft is a result of mining the ground-water resource.[6] Seasonal and cyclical overdrafts are observed only as variations on an over-all trend. Total draft in a particularly wet year may be less than total recharge, but, when cumulated over a complete climatic "cycle," draft may exceed recharge or the safe yield draft volume. Long-run overdraft has been present in Antelope Valley for nearly 20 years, accumulating a deficit of nearly 2,000,000 acre-feet and an increase of more than 100 feet in pumping lifts.[7] Nevertheless, Valley farmers have continued to mine the resource, hastening depletion.

As Water Levels Decline, Costs Increase—But Not Uniformly

Historical and anticipated effects of a falling water table can be related to operator's earnings to stress the fact that as water levels decline, costs increase and returns decrease.[8] Table 1 compares the Antelope Valley alfalfa enterprise at four different periods. Temporal and managerial factors have been averaged (in a median sense) for the periods considered.

[5] Draft estimates based on water requirements of crops and changes in ground-water levels were also made but were not as satisfactory as those based on electrical power consumption. See: J. Herbert Snyder, *op. cit.*, pp. 137-200.

[6] The differentiation of types of overdraft as a logical analytical tool in ground-water research and an evaluation of routine institutional attempts to combat overdraft in Antelope Valley will be treated more extensively in a forthcoming publication.

[7] J. Herbert Snyder, *op. cit.*, pp. 201-226.

[8] Operator's Earnings (Labor and Management Income): Net farm income less an allowance for interest for the use of farm capital. This is compensation for operator's labor and management including the value of living obtained from the farm.

Size of operation is assumed typical for new enterprises established during the period considered.

A four-fold increase in investment or fixed pumping cost occurred as water levels declined between 1920 and 1952.[9] In spite of long-run overdraft on the ground-water stock resource of the Valley, the effect of increased costs of pumping as influenced by a falling water table has been offset by other factors.

Pumping costs are affected by number and size of pumps, power rates, energy sources, volume of water pumped, and technological change, in

TABLE 1. TYPICAL COSTS, RETURNS, AND OPERATOR'S EARNINGS FOR ALFALFA HAY, ANTELOPE VALLEY, 1920–1952[a]

	1920–1929[b]	1930–1939[b]	1940–1949[c]	1946–1952[c]
	Feet			
Assumed total pumping lift[d]	90	130	165	200
	Dollars per acre			
Cash costs of production, excluding pumping cost	36.60	29.15	35.25	62.10
Noncash costs[e]	14.00	15.00	28.50	50.00
Pumping cost of water per acre	15.25	13.00	16.75	20.50
Total cost of production	65.85	57.15	80.50	132.60
Total return per ton alfalfa	15.00	10.50	19.75	23.75
Total returns	93.00	65.10	122.45	147.25
Operator's earnings	27.15	7.95	41.95	14.65

[a] Based on water application of 5 acre-feet and yield of 6.2 tons per acre
[b] Typical for 40- and 80-acre alfalfa units.
[c] Typical for 120- and 160-acre alfalfa units.
[d] Typical for the period indicated.
[e] Depreciation and interest on pump, well, and distribution system, constitute more than one-half of the noncash costs.

addition to water table level. Each factor influences pumping costs, but seldom independently of the others.

Falling water levels affect both fixed and variable costs. As pumping lifts increase, larger and more expensive pump units and deeper wells are required. Other things being equal, larger units consume more energy.

A desired volume of irrigation water may theoretically be obtained in a given time period by using several small pumping installations or one large unit. Practically, use of one large pump as opposed to several small ones allows a farmer to contend with more severe fluctuations in pumping

[9] Deflation of this increase by the "Purchasing Power of the Dollar" (U. S. Department of Commerce) and the "Index of Prices Paid by Farmers for Machinery" (U. S. Department of Agriculture) indicated a two-fold increase investment costs as water levels declined over this period.

lifts and permits pumping from greater depths at lower total cost per acre-foot of water.

Power rates applicable to pumping are usually divided into groups, depending upon pump installation size. Other things being equal, the rate per kilowatt-hour of electricity is less for large than for small units. Combining this with the "block system" of electrical power rates, variable pumping costs may be less with large units than with small units, depending upon the volume of water pumped. Increased crop yield resulting from increased irrigation may further enhance this benefit. The energy source used affects both fixed and variable costs, but the relative economy of particular energy sources will depend upon local conditions. Technological innovation has influenced pumping costs, and thus far has kept pace with the falling water table, helping to offset cost increases.

These factors raise certain issues that complicate the problem of evaluating pumping costs. First, some pumping costs that appear to be fixed for farmers in the short-run are in fact variable because of changes over time. Others are variable at a particular time between individuals.

Second, variable pumping costs are not variable in the traditional theoretical sense. They are in fact fixed in a discontinuous fashion, because of price-characteristics of the energy source. Price changes in the cost of the energy source as a result of volume of energy used at the same time production takes place causes a discontinuous cost function.

Operator's Earnings Affect Conservation

The variation in operator's earnings as pumping lifts increase was synthesized for alfalfa and other crops, as shown in Table 2. Assumptions underlying this table are several: (1) Size of enterprise is approximately 160 acres. (2) Average 1946-1952 cost-price relations. (3) The pump, motor and assembly are capable of handling an increase in pumping lift of about 100 feet before replacement is necessary. (4) Replacement of the old pump and motor is a capital expenditure incurred about every 100 feet and the addition to total annual fixed charges and resulting change in operator's earnings will be small when the change occurs. This permits the problem to be considered as one of change in pumping costs, not of change in fixed plus variable costs.

Until total pumping lift exceeds 450 feet, all listed enterprises yield positive returns. The farmer receives greater returns per acre from alfalfa than from the other crops, with the exception of watermelons and castor beans.[10] Because of the greater volume of water used for the several alfalfa enterprises and irrigated pasture compared to the field crops, the rate of

[10] Watermelons and castor beans are not favored for large scale development in Antelope Valley at present.

decrease in returns as pumping lift increases is greater with the alfalfa and pasture enterprises.

Rigid conservation of the ground-water stock resource—i.e., the exclusion of mining by restricting draft to the safe yield volume—and maximization of individual farm incomes are not necessarily consistent long-run objectives.[11] Furthermore, maximum net social income over the long run is not necessarily consistent with rigid resource conservation.

Two factors bear directly upon this issue for Antelope Valley:

First, the hypothesis has been stated that Valley farmers apply too much irrigation water to their alfalfa crops. That is, they exceed minimum

TABLE 2. TYPICAL OPERATORS' EARNINGS ASSOCIATED WITH VARIABLE PUMPING LIFTS FOR SEVERAL CROPS IN ANTELOPE VALLEY[a]

Crop	Water application, acre-feet per acre	Yield per acre	Total pumping lift, feet					
			100	200	300	400	500	600
			Dollars per acre					
Alfalfa	5.0	6.2T	23.50	23.00[b]	17.30	12.20	6.80	1.20
Alfalfa	6.25	7.2T	38.02	36.59[b]	29.59	23.27	16.59	9.77
Alfalfa (contract baled)[c]	5.0	6.2T	15.75	15.25[b]	9.55	4.45	−0.95	—
Castor beans	2.5	2,000 pounds	64.59	59.64	55.56	59.21[b]	56.56	53.56
Field corn	2.5	5,000 pounds	20.28	15.33	11.25	14.90[b]	12.25	9.25
Cotton	2.5	600 pounds	14.84	9.89	5.81	9.46[b]	6.81	3.81
Milo maize	2.5	4,000 pounds	12.10	7.15	3.07	6.72[b]	4.07	1.07
Irrigated pasture	5.0	600 pound gain	19.96	19.46[b]	13.76	8.66	3.26	—
Potatoes	2.5	2,500 pounds	21.68	16.73	12.65	16.30[b]	13.65	10.65
Watermelons	2.5	10T	44.52	39.57	35.49	39.14[b]	36.49	33.49
Irrigated wheat (double cropped)	2.5	4,200 pounds	22.01	17.06	12.98	16.63[b]	13.98	10.98

[a] 1946–1951 average cost-price relationships assumed.

[b] Discontinuities occur as demand horsepower reaches a level of 100 H.P. which permits shifting to a more favorable power rate schedule.

[c] Two enterprises assume a water application of 5 acre-feet per acre per year and one of these is contract baled while the operator performs his own baling on the other. The third alfalfa enterprise assumes a water application of 6.25 acre-feet per acre per year, operator performed baling, and a higher yield than the other two. This yield increase, a supposition for this study, is based on an investigation in the Salt River Valley of Arizona in which a 1 ton increase in alfalfa yield occurred (from 7 to 8 tons) as the volume of water applied was increased from 5 to 6.25 acre-feet per acre. J. C. Marr, *The Use and Duty of Water in the Salt River Valley*. Tucson, July, 1927. pp. 63–97. Ariz. Agr. Exp. Sta. Bul. 120.

theoretical requirements. The corollary states that it will "soon" be uneconomic to pump irrigation water. Projecting the relationships and assumptions of Table 2 indicates that water levels can decline to 400-600 feet before negative returns are incurred, assuming no change in cost-price or technological relationships.

Second, the contradiction between rigid conservation and maximization of farm income brought forth suggestions for shifts from alfalfa to crops that consume less water. Excluding for the moment such specialty crops

[11] As used herein, conservation is defined in terms of ". . . changes in the intertemporal distribution of use. In conservation, the redistribution of use is in the direction of the future; . . ." S. V. Ciriacy-Wantrup, *Resource Conservation, op. cit.*, pp. 51-53.

as watermelons and castor beans, transfers from alfalfa are not indicated until total pumping lift approaches 400 to 450 feet. Current experiments with field corn indicate a possible transfer at more shallow depths, especially for small farms with pumps discharging relatively small volumes of water.[12]

In the Valley there is little incentive to transfer to crops that consume less water so long as alfalfa remains more profitable than most crops currently grown there. Should transfer occur, the annual draft on groundwater stock resources to supply an estimated 65,000 acres of low water-consuming crops would still exceed by three-fold the average annual recharge.

Possible Future Developments

Using the foregoing material and assumptions, possible future development in Antelope Valley may be projected in terms of hypothetical alternative opportunities. It is asumed that the projection is to be made for a ten-year period, examining the water resource and irrigated crop development for the year 1963. A ten-year interval is a limited time period relative to the stock of ground water available for use.

Hypothetical shifts in acreage to crops which use relatively small amounts of water are assumed to evolve gradually from present acreages. The cost-price-yield relationships developed above are assumed for the period of projection, as are the relationships between the operator's earnings and declining water table, which starts with a 200 foot pumping lift and increases in the several cases. Pumping plants in existence at the beginning of the period are assumed to be able to adjust to the increased pumping lifts. The only cost increase is assumed to be in the variable pumping costs, as the pumping lift increases. Nonirrigated land use and incomes are assumed constant for the period. The projections are summarized in Table 3.

Case 1—No major changes in crop acreages. If no major changes occur in crop acreages, by 1963 the pumping lift will have increased about 69 feet from 1953 levels, as a result of cumulative overdraft of 1,480,000 acre-feet for the period. Total operators' earnings are estimated at $1,150,000 for 1963, a decrease of $110,000 from 1953 levels. The change in aggregate operators' earnings for the Valley is brought about entirely by increased costs of pumping as the ground-water levels continue their decline. If the acreage under irrigation increases, overdraft and pumping lifts will increase and operators' earnings decrease.

Case 2—Major shift from alfalfa to field corn. Major shifts from alfalfa

[12] Experimental corn yields have exceeded 150 bushels per acre, but commercial yields approximate those indicated in Table 2.

to corn may occur because many small farms in the Valley are not equipped with pumping plants that can supply enough water to plant the entire farm to alfalfa. Large scale poultry enterprises in the Valley provide a local demand for feed conveniently suppliable by local corn producers.[13]

It is assumed that 25,000 acres are shifted from alfalfa to field corn. By 1963, the pumping lift will have increased only 56 feet and cumulative overdraft will have been cut to 1,200,000 acre-feet. Annual on-farm water savings will have amounted to about 1.2 acre-feet per acre. Total operators'

TABLE 3. PROJECTIONS OF ANTELOPE VALLEY IRRIGATED AGRICULTURE FOR 1963

Case number	Alfalfa	Field corn	Irrigated pasture	Miscellaneous fruit, field, and vegetable	Specialty vegetable	Total irrigated acreage	Estimated increase in pumping lift for 1954–1963	Total operators' earnings from all crops	Change in total operators' earnings compared with 1953
	acres	*acres*	*acres*	*acres*	*acres*	*acres*	*feet*	*dollars*	*dollars*
1	44,000	1,000	5,000	15,000		65,000	69	1,150,000	− 110,000
2	20,000	25,000	5,000	15,000		65,000	56	1,120,000	− 140,000
3A	20,000	20,000	5,000	10,000	10,000	65,000	56	1,450,000	+ 190,000
3B	5,000	20,000	5,000	10,000	25,000	65,000	47	1,950,000	+ 690,000
4		20,000		10,000	35,000	65,000	42	2,300,000	+1,040,000
5A		10,000			20,000	30,000	33	1,200,000	− 60,000
5B		5,000			15,000	20,000	24	860,000	− 400,000

earnings are estimated at $1,120,000 or $140,000 below 1953 levels. The change in operator's earnings results from decreased pumping costs resulting from a smaller total pumping lift and decreased earnings from corn as compared with alfalfa. The two factors act in opposite directions, but losses resulting from the shift will have more than offset the gain from decreased pumping lifts.

Case 3—Major shifts from alfalfa to field corn and special vegetable crops. Two levels of shift are demonstrated, depending upon the degree of shift to specialty vegetable crops. Two factors combine to permit the supposition of transfer to vegetable crops: First, rapid urbanization around Los Angeles is removing substantial acreage from commercial vegetable production. Second, the smog problem is hastening abandonment of commercial vegetable crop acreage. Experiments at the Antelope Valley Field Station of the University of California indicate that such commercial vegetable crops as sweet corn, melons, watermelons, squash, strawberries, bush berries, sweet potatoes, onions, carrots, beets, lima beans, and cucumbers can be grown successfully in Antelope Valley.

Case 3A assumes a shift of 10,000 acres to commercial vegetable crops of this type. By 1963, the pumping lift will have increased 56 feet over 1953 levels as a result of a cumulative overdraft of 1,200,000 acre-feet. Total operators' earnings are estimated at $1,450,000 for 1963, or $190,000

[13] In 1953 Antelope Valley field corn production from 1,500 acres supplied less than 7 percent of the annual feed grain requirement of the poultry enterprises.

above 1953 levels. This increase is primarily attributable to increased operator's earnings associated with the specialty vegetable crops. A slight contribution will also be made by decreased pumping costs associated with smaller pumping lifts.

Case 3B assumes to specialty vegetable crops of 25,000 acres and a greater reduction in alfalfa acreage. By 1963 the pumping lift will have increased 47 feet over 1953 levels as a result of cumulative overdraft of 1,020,000 acre-feet. Total operators' earnings are estimated at $1,950,000 or $690,000 above 1953 levels. This increase results from increased operator's earnings associated with specialty vegetable crops and decreased pumping lift, but to a greater degree than in Case 3A.

Case 4—Abandonment of alfalfa enterprises. If the volume of water that can be applied per acre should be regulated by law and set at a level below the amount necessary to irrigate alfalfa, the abandonment of alfalfa and irrigated pastures in Antelope Valley could occur.[14] It is assumed that specialty vegetable crops would absorb such acreage.

By 1963 the pumping lift will have increased 42 feet over 1953 levels as a result of cumulative overdraft of 900,000 acre-feet. Total operators' earnings are estimated at $2,300,000 or $1,040,000 above 1953 levels. Greater earnings associated with specialty vegetable crops and lesser pumping costs associated with smaller lifts combine to bring about aggregate operators' earnings greater than those anticipated in cases 1 to 3.

Case 5—Major reductions in irrigated crop acreage. Maintaining irrigated crop acreage in Antelope Valley at 65,000 acres will not permit sufficient reduction of draft to eliminate long-run overdraft at present levels of ground-water recharge. Case 5A assumes a reduction to 30,000 acres, all planted to field corn or specialty vegetable crops. By 1963 the pumping lift will have increased 33 feet over 1953 levels as a result of a cumulative overdraft of 700,000 acre-feet. Total operators' earnings are estimated at $1,200,000 or $60,000 below 1953 levels. Severe reduction in acreage more than offsets the gain from a shift to specialty vegetable crops and decreased pumping lifts.

Case 5B assumes a reduction to 20,000 acres, all planted to field corn or specialty vegetable crops. By 1963 the pumping lift will have increased only 24 feet over 1953 levels, as a result of cumulative overdraft of 510,000 acre-feet. Average annual draft and average annual recharge will finally be in balance, terminating the condition of long-run overdraft. Total operators' earnings are estimated at $860,000 or a decrease of

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[14] One suggestion was made to limit pumpage volume to 5 acre-feet per acre per year in Antelope Valley. This volume would not cause major abandonment of alfalfa acreage. No official action has ever been taken on this recommendation. Snyder, *op. cit.*, p. 315.

$400,000 from 1953 levels. For comparison, if all acreage is maintained in alfalfa and the total acreage reduced until recharge equaled draft, only 12,500 acres will be irrigated and aggregate operators' earnings will be $230,000 or a reduction of $1,030,000 from the 1953 levels.

Are Such Developments Likely?

Any of the assumed shifts in crop patterns could occur in the Valley. It is unlikely, however, that acreage reductions sufficient to bring average annual recharge into balance with average annual draft will occur within the next ten years. Past experience indicates the profitability of mining the ground-water resource.

Typical variable pumping costs in Antelope Valley during 1925-1953 remained relatively constant or decreased, due to declines in power rates and improved pumping plant efficiency. Variable pumping cost to pump 1,200 acre-feet of water in 1925 from a depth of 100 feet amounted to $3.50 per acre-foot. The same volume of water pumped from a depth of 200 feet in 1952-53 cost between $2.50 and $3.65 per acre-foot, depending upon the particular rate schedule used. An improvement in over-all pumping efficiency of 10 percent for a particular pumping plant permits pumping *at the same cost* from a depth of 40-50 feet greater than that before the improvement. The economies gained from larger pumping plants and more powerful motors caused a shift from small pumps to a relatively smaller number of large pumps.

Shifts from diesel and gasoline to electrically powered pumping units after 1930 resulted from reductions in electrical energy charges. Electrically powered units possess additional advantages over other energy sources: "block system" of power charges and decreased costs of repairs, lubricants, and attendance.

Increasing the irrigation water applied to alfalfa affects the marginal cost of water enough to permit decreased costs per acre-foot of water. Increases in yield associated with increased water application were sufficient to raise net farm income. This relationship suggests a conflict between ground-water resource conservation and economic utilization.

In spite of declining ground-water levels, Antelope Valley has continued agricultural expansion and intensified overdraft. Technological innovation has, *so far,* kept pace with the increasing costs normally associated with a falling water table. Mining the ground-water stock resource has naturally resulted.

In dollars and cents terms, Valley farmers have profited from mining. For example, using the ground-water stock at a safe yield rate (draft = recharge) and devoting the entire amount to alfalfa production, it is estimated that operators earnings from alfalfa for the period 1927-1950

would have totaled less than $5,000,000. Actually, for only the period 1947-1950, alfalfa operators' earnings alone totaled $4,500,000. Thus income generated by mining the ground-water stock resource may easily exceed a perpetuity income resulting from maintaining balance between recharge and draft. The determination of this "optimum state of conservation"—defined in terms of maximum discounted net revenue over time—will call for periodic reappraisals as conditions change.[15]

Examination of historic price variations shows that, relative to many alternative crop possibilities, alfalfa has retained a relative advantage. Major shifts out of alfalfa will depend upon satisfactory net returns from other crops or restrictions on available water. Although major shifts in particular crops grown in the area may occur to conserve the ground-water stock resource and reduce overdraft, elimination of long-run overdraft is not a strong probability within the next ten years.

Economic forces associated with cost-price conditions and technological advancement have stimulated and perpetuated long-run overdraft in Antelope Valley. To the degree that they continue, overdraft will continue —until the economic limits of pumping force abandonment of sufficient acreage to bring recharge into balance with draft, or until water importation can be achieved in sufficient volume and at reasonable costs to bring about a similar balance. Economic, social, and institutional factors generally tend to favor the latter solution of transferring water from surplus to deficit areas.

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[15] S. V. Ciriacy-Wantrup, *op. cit.*, pp. 76-93.

MARKETING HOGS ON THE CHICAGO MARKET*

E. S. Clifton, R. J. Jessen, and E. M. Jacobs**
Iowa State College

THE purpose of this paper is to present the results of two phases of a recent study on certain aspects of the efficiency with which the hog marketing system operates. The general problems under consideration were those of (1) determining the wholesale "cutout" values of hogs in the three main grade classes and (2) determining the differences in the prices which buyers pay for live hogs in each of these classes. The relationship between these "wholesale value" differences and "sales price" differences provides a measure of the efficiency of an important part of the hog marketing system.

The two phases are related in the following way: The first study is concerned with possible differences in "value" of the grades of hogs and attempts to measure them. The second study attempts to measure the extent to which these "value" differences are "recognized" by buyers on the Chicago market.

One limitation of this study is that the hogs (in the "wholesale value" study) were graded on a carcass basis (whereas those in the "sales price" study) were graded on a live basis. These two bases of grading do not necessarily give identical results. Thus, the results of the two phases may not be directly comparable.

Data used for determining the wholesale values were obtained from 180 hogs. The carcasses of the hogs were selected in the coolers of a commercial packing plant in 1948. The carcasses weighed from 140-170 pounds (approximately 200-240 pounds liveweight). Measurements of the carcass weight, backfat thickness, and carcass length were obtained for each carcass. The carcasses were sorted into the government grade classes using backfat thickness and carcass weight as criteria. They yielded 59 Choice 1's, 73 Choice 2's and 48 Choice 3's. These carcasses were cut into wholesale cuts according to regular commercial cutting procedures and each wholesale cut was weighed. The wholesale value of each carcass was obtained for the period of January 13 to February 5, 1953, by multiplying the weight of each cut by the Chicago average wholesale price for that weight cut as quoted by the National Provisioner.

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* Journal Paper No. J-2365. Iowa Agricultural Experiment Station, Ames, Iowa, Projects, 984, 1005, and 1230. This study was made possible by grant-in-aid funds from the Chicago Union Stock Yard and Transit Company.

** The authors acknowledge the assistance of the following people in conducting the study and preparing the manuscript: W. Lyle Fitzgerald, Agricultural Economist, Chicago Union Stockyards and Transit Co.; Allan Nash, retired hog buyer, Wilson and Co., Inc., James R. Wiley, Prof. of Animal Husbandry, Purdue University, and H. O. Hartley, Prof. of Statistics, Iowa State College.

No allowance was made for quality differences in the price of wholesale cuts because wholesale pork prices are quoted on a weight basis only. The wholesale value per 100 pounds carcass was determined by the following formula:

$$V = \frac{\sum_{i=1}^{14} P_i W_i}{X} \times 100$$

Where V = individual carcass value per 100 pounds
P = price
W = weight of wholesale cut
X = carcass weight
i = wholesale cut[1]

These carcass values were converted to live values by multiplying by the following dressing percentages:[2]

Choice 1	70.0%
Choice 2	70.9%
Choice 3	71.8%

Value Differentials

The average Choice 1 hog was estimated to be worth about 29 cents per hundred pounds live weight more than the average Choice 2 hog. The average Choice 1 hog was worth 65 cents more than the average Choice 3 hog (Table 1). These results are in agreement with the results reported by a commercial packer. Out of several thousand hogs tested, it was found that their "select grade" cut out 37 cents more per hundred pounds live

TABLE 1. ESTIMATED DIFFERENCES IN WHOLESALE CUTOUT VALUES FOR 180–240 POUND HOGS BY GRADES, JANUARY 13 TO FEBRUARY 6, 1953

Grade	Average value per cwt. (liveweight) ($)	Differences in value ($)
Choice 1	20.95	
Choice 2	20.66	.29
Choice 3	20.30	.36
	Total difference	.65

[1] The wholesale cuts that were used are:

Hams	Picnics	Spare ribs	Neckbones
Loins	Fatbacks[4]	D. S. jowl butts	Feet
Bellies	Boston butts	Fat trim	Tail
		Regular pork trim	Special pork trim

[4] Fatbacks were priced as fatbacks or lard whichever gave the larger return.

[2] The difference in yields by grades was obtained from: G. Engelman, et al. *Relative Accuracy of Pricing Butcher Hogs on Foot by Carcass Weight and Grade,* Minn. Agr. Exp. Sta. Tech. Bul. 208. June, 1953.

weight than the average of all hogs in their plant.[3] This gives an indication of the differentials a buyer can pay for these grades of hogs based on differences in the values of the wholesale pork cuts.

The value differences of the grades are due to the relative weights of the cuts. The four lean cuts (picnics, hams, loins, and boston butts) constitute about 44 to 52 percent of the carcass weight and 65 to 75 percent of the carcass value at the time this study was conducted. The hogs which yield a high percentage of their carcass weight in the four lean cuts are more valuable than those which yield a low percentage of their carcass in the four lean cuts.[4]

Price Differentials

An experiment was designed to determine the price differentials paid for the different grades. The prices paid for the grades of hogs were taken from sales records of hogs sold at the Chicago Union Stockyards. The test lots were consigned to the Chicago market in such a manner that neither the buyers nor sellers were aware that the experiment was being conducted.

The structure of the experiment was somewhat unorthodox. With the personnel available, only six lots of hogs could be prepared for sale on a given day. The grade classes tested were:

(1) U. S. Choice 1 (2) U. S. Choice 2 (3) U. S. Choice 3 (4) A mixed lot including ⅓ of each of the above grades.	These three grades constitute about 80-85 percent of the hogs marketed in the United States

By including (4), the mixed lot, a measure could be obtained of the buyers' price discrimination between "pure" and "mixed" lots.

In order to have an adequate measure of "residual error" (the variation in prices received by lots of the same grade sold the same day by the same commission firm), it was necessary to provide a minimum of two test lots of the *same* grade each test day. Moreover, two lots of different grades had to be provided to the market on a test day in order to obtain a measure of price differentials due to grade differences. To measure the price effect attributable to commission firms, it was necessary to have at least two

[3] W. C. Jackson. Problems in More Selective Hog Grading (Speech presented at Farm and Home Week). University of Illinois. February 4, 1953. (Processed)

[4] For a more complete discussion of the value differences of the different grades of hog carcasses, see: North Central Livestock Marketing Research Committee. *Objective Carcass Grade Standards for Slaughter Hogs.* North Central Regional Publication 30. University of Minnesota. June, 1952, pp. 21-25. James R. Wiley, et al. *Objective Carcass Factors Related to Slaughter Hog Value.* Purdue Agr. Exp. Sta. Bull. 567. December, 1951, pp. 16-20. G. Engelman, et al. *Marketing Slaughter Hogs by Carcass Weight and Grade.* Minnesota Agr. Exp. Sta. Tech. Bul. 187. April, 1950, pp. 43-46.

different firms each presented with at least two lots of the same grade on the same day.

Considering these conditions, the assignment of the six lots of approximately 18 hogs each[5] would be like this:

Lot No.	Grade No.	Firm Designation
1	2	A
2	2	A
3	1	A
4	4	B
5	4	B
6	1	B

A form of balance can be obtained by repeating this scheme over 12 days and over 12 commission firms such that each grade appears an equal

TABLE 2. GENERAL LAYOUT OF THE EXPERIMENTAL PLAN

Day	Grade classes of lots			Commission Firms
1 (Jan 13)	2	2	1	A
	4	4	1	B
2 (Jan. 14)	2	2	1	A
	3	3	1	C
3 (Jan. 15)	1	1	2	D
	3	3	2	E
4 (Jan. 20)	3	3	2	E
	4	4	2	F
5 (Jan. 21)	2	2	3	G
	4	4	3	H
6 (Jan. 22)	1	1	4	J
	2	2	4	K
7 (Jan. 27)	1	1	3	L
	4	4	3	H
8 (Jan. 28)	2	2	4	K
	3	3	4	M
9 (Jan. 29)	1	1	3	L
	2	2	3	G
10 (Feb. 3)	1	1	4	J
	3	3	4	M
11 (Feb. 4)	3	3	1	C
	4	4	1	B
12 (Feb. 5)	1	1	2	D
	4	4	2	F

[5] The average size of lot sold on the Chicago market is about 18 to 20 head.

number of times upon completion. The structure for the 12-day period (before randomization) is given in Table 2. The 12 commission firms were chosen from a total of about 50 with probability proportional to the sales of each during 1952 (drawn without replacement).

Sales for the experiment were made in Chicago on Tuesdays, Wednesdays, and Thursdays during the period January 13 to February 5, 1953. A total of 72 lots were sold and the data obtained are shown in Table 3.

TABLE 3. PRICE PER HUNDREDWEIGHT RECEIVED IN THE CHICAGO MARKET FOR EACH OF 72 LOTS SOLD

(Figures are in dollars per 100 weight)

Day	C.F.	g_1		g_2		g_3		g_4	
1	A	18.500		18.500	18.472				
	B	18.000						18.000	18.000
2	A	18.600		18.600	18.600				
	C	18.750				18.500	18.500		
3	D	19.250	19.250	19.210					
	E			18.750		19.000	18.750		
4	E			19.400		19.400	19.400		
	F			19.250				19.250	19.250
5	G			19.150	19.150	19.150			
	H					18.750		19.000	19.100
6	J	19.500	19.500					19.500	
	K			19.500	19.250			19.500	
7	L	19.000	19.150			19.000			
	H					19.150		19.150	18.900
8	K			19.400	19.400			18.900	
	M					19.000	19.000	19.100	
9	L	19.000	19.150			18.900			
	G			19.227	19.250	19.250			
10	J	19.250	19.250					19.061	
	M					19.000	19.000	19.000	
11	C	19.253				18.900	18.900		
	B	19.250						19.000	19.000
12	D	19.300	19.271	19.350					
	F			19.250				19.250	19.250

Value Versus Price Differentials

When the grade class means of the "wholesale values" for each live hog were computed, a difference of 29 cents resulted between Choice 1 and Choice 2 grades and 65 cents between the Choice 1 and Choice 3 grades (Table 1). The order of values obtained are as expected.

The differences in values between grades were examined by representing the mean of the class means as zero and the difference for each grade from that base. The following was obtained:

Grade Class	Estimated "grade effect" on "wholesale value" Cents per 100 lbs. live weight
No. 1	+31
No. 2	+ 2
No. 3	−34
Mean of 1, 2, and 3	0

The average Choice 1 carcass was estimated to be worth 31 cents more than the average of the three grades.

The analysis was carried out in two stages: (1) the estimation of price differentials paid for the several grades and (2) the estimation of price differentials (if any) paid on different days and to different firms, and other related estimates.

This investigation extends over 12 days with two "transactions" by different firms on each of the days so that there are 24 "transactions" in all. These "transactions" can be split into 6 groups of 4 "transactions" each, as shown in Table 4 where it will be seen that Group I consists of transactions in which grades 1 and 2 were priced and Group II with transactions grades 1 and 3 were priced, etc.:

TABLE 4. AVERAGE PRICES PAID FOR GRADES TO FIRMS A TO M ON DAY SHOWN

Group	Day No. and Firm	Grade 1	Grade 2	Grade 3	Grade 4	Price Diff. ($)
I	1A, 2A, 3D, 12D	18.91	18.91			
II	2C, 11C, 7L, 9L	19.04		18.83		0.21
III	1B, 11B, 6J, 10J	19.00			18.89	0.11
IV	3E, 4E, 5G, 9G		19.14	19.17		−0.03
V	4F, 12F, 6K, 8K		19.32		19.23	0.09
VI	5H, 7H, 8M, 10M			18.97	19.04	−0.07

The following price differentials for the four grades were obtained:

Grade:	1	2	3	4
Price Differential (cents):	+8.0	+1.6	−6.2	−3.4

Grade 4 is a mixed lot. It is of interest to note that its price differential was −3.4 cents below the average of the three grades (+1.1 cents). Hence, an addition of an estimated 4.5 cents per hundredweight is gained through grading.

In Table 5 a complete Analysis of Variance of price differentials by grades is presented.

Using the "replicate" mean square as "experimental error" the between grade mean square is highly significant, statistically. Using the Grade X Transactions mean square as "experimental error" the F-ratio is 1.98 which is not significant. These two tests show that at each transaction,

TABLE 5. ANALYSIS OF VARIANCE FOR TESTING GRADE DIFFERENCES

Source of Variation	Degrees of Freedom	Mean Square
Between hogs of same grade in a transaction (Relicates)	24	.00510
Between Transactions	23	.34379
Between Grades	6	.03196
Grades×Transactions	18	.01612

differential prices are paid for the several grades and with average values as indicated above, but that there is a considerable variation in these differential prices from transaction to transaction (mainly from day to day).

Having estimated the average differential prices for grades and subtracting these from the prices of Table 3 (in order to eliminate the effect for grade) the prices, adjusted in this manner, for differences between days and firms were analyzed. The mean prices obtained in each of the 24 transactions (and adjusted for grade differences as indicated above) are presented in Table 6.

TABLE 6. TOTAL PRICES PAID FOR 3 LOTS OF HOGS IN EACH OF THE 24 TRANSACTIONS

Day No.	Firm			Day No.	Firm		
	A	B	C		D	E	F
1	18.45	18.00		3	19.18	18.87	
2	18.56		18.60	12	19.25		19.27
11		19.08	19.03	4		19.44	19.27
Day No.	Firm			Day No.	Firm		
	G	H	L		J	K	M
5	19.16	18.99		6	19.46	19.42	
9	19.25		18.98	10	19.14		19.05
7		19.11	19.02	8		19.24	19.09

The 24 transactions are arranged in 4 "quarters" of 6 transactions each, wherein each quarter deals with the transactions of 3 firms on 3 days. The analysis of variance of these data are shown in Table 7. (It is based on the Incomplete Randomized Block Analysis.)

To test differences between firms, one may compare the Between Firm mean square, 0.0554, of this analysis with:

(1) the Replicate mean square of .00510 in Table 5, and
(2) the Remainder mean square of .0677 in Table 9.

It is significant when tested against (1) but is insignificant when tested against (2). This means that although the firms may sell hogs at different prices on a particular day, these differences do not persist from day to

day—that is, Firm A may be selling hogs, of all grades, higher than Firm B on day 1 but on day 2 the reverse might be observed.

Applying the same test to the difference between days, a somewhat similar result is obtained, that is, the between day mean squares, .3141, is highly significant when tested against (1) and insignificant when tested against (2). This means that hog prices vary from day to day (a well known

TABLE 7. ANALYSIS OF VARIANCE FOR TESTING DAY AND FIRM DIFFERENCES

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Transactions	23	7.9583	.3461
Between Quarters	3	4.4134	1.4711
Within Quarters	20	3.5449	.1772
Days, Ignoring Firms	8	2.8285	.3536
Between Firms	8	.4428	.0554
Remainder	4	.2736	.0677
Firms, Ignoring Days	8	.7612	.0952
Between Days	8	2.5130	.3141
Remainder	4	.2707	.0677

characteristic of the market!). Prices do not affect all firms to the same extent on a given day, also this effect differs from day to day. Thus, day 1 may be a good day for firm A but not so good for firm B, but on day 2 the reverse may be true.

Price differentials exist for any day and firm but they are not very stable between firms and time. It is difficult to determine, with reasonable precision, the magnitudes of "price differentials," due to grade, "existing" in the Chicago market. During the period of the investigation, January 13 to February 5, 1953, the estimated "average" differentials from the mean of grades 1, 2, and 3 were:

No. 1	+ 6.9 cents
No. 2	+ 0.5 cents
No. 3	− 7.4 cents

Assuming the "value differentials," due to grade, existing during this period to be:

No. 1	+ 31 cents
No. 2	+ 2 cents
No. 3	− 34 cents,

The two differentials are not in agreement, except in ranking. At first glance it might appear that buyers are not paying the price differentials for the several grades that the wholesale values of these grades seem to justify. Direct comparison of these results is not possible because the method of grading might not give identical results.

Summary and Conclusion

1. Two phases of a study on hog buying efficiency were described and the results presented. They were (1) an investigation of the values of hog carcasses as determined from the wholesale values of the cuts yielded in each of the three official U. S. hog grade classes, U. S. Choice 1, U. S. Choice 2, and U. S. Choice 3, (2) an investigation of the prices buyers on the Chicago market actually pay for hogs in these three grade classes and a mixed class.

2. It was estimated that the average Choice 1 hog was worth about 65 cents per 100 pounds live weight more than the average Choice 3 hog and 29 cents more than the average Choice 2 hog.

3. On the average, the buyers on the Chicago market have paid higher prices for the higher grades of hogs. But the grade prices vary from day to day and the difference between the average grade prices are not statistically significant.

4. Different firms sell the same grade hogs at different prices on the same day, but these differences do not persist from day to day—that is, Firm A may be selling hogs of all grades higher than Firm B on day 1, but on day 2 the reverse might be observed.

THEORETICAL ASPECTS OF A TWO-PRICE PLAN TO SELL MORE MILK

EDWIN B. JONES
*Michigan State College**

AT PRESENT, much attention is focused on two-price plans and other discriminatory techniques as a means of selling surplus agricultural products. An approach that might have promise in some markets is the use of intra-consumer price discrimination as a means of selling surplus fluid milk.[1] This paper will attempt to develop some of the theoretical aspects of a two-price plan involving intra-consumer price discrimination in a framework that is applicable to the sale of home delivered fluid milk. Many of the practical and institutional problems involved in selling milk under such a plan will be neglected in this discussion.[2]

Retail price maintenance for fluid milk in face of seasonal surpluses is possible only by virtue of market control exercised by the industry. However, much of the market control existing in the industry has been promoted or sanctioned by governments. Inspection standards and practices, federal and state milk orders and price support programs are among the methods used.

Selling home delivered milk under a two-price plan is only one of a number of alternative plans, all monopolistic, that may be open to the dairy industry. The plan can supplement present pricing practices that exist in many markets, namely retail price maintenance and various versions of classified or use plans. Although a two-price plan is monopolistic by nature and purpose, it may be a closer approximation to "competitive" or "free" market pricing than present retail pricing policies. Efficiency implications in production and consumption are involved which can benefit producers, consumers and milk distributors.

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* This paper is a summary of portions of the writer's dissertation for the doctorate "Intra-Consumer Price Discrimination as a Means of Increasing Milk Consumption," Michigan State College 1953 (unpublished). The writer is particularly indebted to Professor G. G. Quackenbush for his direction and counsel in completing the study. The writer also wishes to acknowledge the assistance of Professors Victor E. Smith, Glenn L. Johnson, L. W. Witt, James Shaffer, Ben C. French and Harold M. Riley for reviewing portions of the study and making many helpful suggestions and comments.

[1] Intra-consumer price discrimination is defined as the situation where an individual consumer is charged different prices for various quantities of the same product at essentially the same point in time.

[2] For a more detailed development of the mechanics and operational problems involving intra-consumer price discrimination as a means of selling milk, see E. B. Jones and G. G. Quackenbush "A Two Price Plan to Sell More Milk," *Quarterly Bulletin*, Mich. Agr. Exp. Sta., Michigan State College, East Lansing, Vol. 37.

The Plan in Brief

A two-price plan involving intra-consumer price discrimination in the sale of delivered milk during the months of flush production would be designed to take advantage of the differential between fluid and manufacturing milk prices as a means of increasing milk consumption. In brief, here is the way the plan would operate. Each household that purchased milk regularly from a routeman would be sold its usual quantity of milk at the regular price. Then this same family would be offered additional milk at a reduced or discounted price. A system similar to the base and surplus plan for producers would be used to allocate milk sold to consumers at the regular and discounted price. For example, suppose a household had been taking three quarts of milk per delivery quite regularly during the fall and winter months. With the approach of the flush spring and summer months the household would be advised that they had earned a base of three quarts per delivery. Further, the household would now be eligible to purchase three quarts at the regular price of (say) twenty-five cents per quart and an additional quart at the reduced price of fifteen cents per quart.

The assumed ten cent reduction on the surplus quart would arise from two sources: (1) The differential between the Class 1 and manufacturing milk price would be passed on to the consumer, since the surplus milk has to be sold at manufacturing prices anyway. (2) Dealers and routemen would be expected to supplement this price reduction by reducing their margins to cover only marginal costs plus a fair profit for handling and marketing the surplus milk. The differential between fluid and manufacturing milk often amounts to 5 cents per quart in many markets. The surplus milk would be bottled in existing plants and distributed to established customers which could make possible economies of another 5 cents per quart.

The allotment of surplus milk that a family could purchase at a discounted price would be restricted to a given percentage of the base allotment. This arrangement would bring about desirable elements of equity in that families would stand to benefit from the plan in proportion to the amount of milk they normally purchased at the regular price. It should also encourage consumers to increase their allotment of base milk to take advantage of the cheaper surplus milk. Restricting the amount of price discounted milk available to any family also reduces the possibility of reselling or giving it to friends and neighbors.

A two-price plan of selling milk is an attempt to select from the market those families which show some response to price variation. If these families can be so segregated, then certain price concessions can be made

to them that would not fundamentally change the rest of the market. A family purchasing additional amounts of surplus milk at a reduced price would probably attain a higher level of satisfaction. If the sale can be made to the family, the dairy industry gains if it can receive a fair profit above the marginal cost of selling the surplus milk. Families who might not desire to increase milk consumption as a result of such a plan would receive no direct benefit nor would they be penalized in any way for non-participation. In other words consumers would be in the very desirable situation that none would be worse off while some would be better off as a result of the two-price plan.

Theoretical Aspects of Uniform or Flat Pricing

The remainder of this paper will be devoted to developing some theoretical aspects of intra-consumer price discrimination. The indifference curve analysis will be used as a basis in constructing a hypothetical demand curve for an individual for fluid milk.[3] The development of demand at this point will be general without regard to price elasticity of demand. The special cases of elastic and inelastic demand will be examined at a later point.

Suppose milk is represented on the horizontal and income or money on the vertical axes (Figure 1a).[4] Since milk is used in a rather uniform pattern by many people on a daily basis, it will be assumed that the indifference curves represent daily quantities and are reconstituted daily at precisely the same pattern as shown in the diagram. Money likewise is assumed to be broken down into a daily allowance.

It is assumed that the price line PQ represents a price for milk of 25 cents per quart.[5] It is tangent to indifference curve II at point E, which indicates in these circumstances that the consumer would give up amount PD of his daily money allotment OP to obtain a quantity of milk equal to OF. With this information point (E) on a consumer's demand curve can be located in Figure 1b. Price line PG represents a lower price for milk than PQ (assume 20 cents per quart) which is tangent to a higher indifference curve at J. Quantity OM of milk would be taken by the individual at 20 cents per quart which corresponds to point J in Figure 1b. The same procedure is followed in locating point H. Price line PR is assumed to repre-

[3] See J. R. Hicks, *Value and Capital*, London: Oxford Press, 1948, Part I and George J. Stigler, *The Theory of Price*, New York: The Macmillan Company, 1947, Part II for a more detailed discussion of the Indifference Curve Analysis.

[4] Money or income is an incorrect classification since it is considered to represent all other commodities for the individual but milk. Milk, however, is usually purchased from the consumer's money resources so will be used as a rough approximation.

[5] Diagrams are drawn to illustrate particular points rather than to represent a scale model or a reasonable purchase pattern for milk.

sent a price of 15 cents per quart for milk. At this price the individual would be willing to give up PB of his money in order to purchase ON quantities of milk. Figure 1b shows the individual would purchase quantity ON of milk if the price were 15 cents per quart. A series of points, similar to EJH, can be located. When the series of points join the conventional demand curve or schedule is the result as shown.

The individual demand curve that has been derived from the indifference map is a typical demand schedule. Economists usually have this type of schedule in mind when they talk about individual demand. Oskar Morgenstern has pointed out that many of the concepts and definitions expounded about such a demand curve do not stand up under vigorous investigation.[6] He emphasizes that points on an individual's demand curve are considered to be a series of simultaneous alternative maximum bids for the quantities associated with each price. These alternative maximum bids are not independent of each other.

A consumer's demand curve derived from an indifference map using flat pricing suggests that as soon as one transaction takes place at one price and quantity, the curve ceases to exist. After an equilibrium position is reached and a transaction is completed at one point, other points on the demand curve in Figure 1b become meaningless for that particular day. If a transaction takes place at a flat price of 20 cents per quart (point J) all other points on the demand curve are invalidated. All quantities at a higher price disappear completely. Those additional quantities at a lower price that the consumer might be willing to purchase are not indicated by the original demand curve in Figure 1b. It is very possible that the consumer might buy additional quantities of milk at lower prices after the transaction at 20 cents per quart has been completed. However, there is no way to discover these quantities at lower prices from the demand curve that was derived in Figure 1b.

A demand curve built up from an indifference map with flat pricing and containing both income and substitution effects is designed to describe the alternative actions of the individual consumer. It can not be used to describe successive actions which is required in the case of intra-consumer price discrimination.

Morgenstern states that the only way the original demand curve has meaning after one alternative transaction has taken place is through a reconstitution of the demand curve. He claims an individual's demand curve has been reconstituted when:

"(a) either a new income payment and consequently a confirmation of his previous expenditure plan has reproduced a future demand curve (identically

[6] Oskar Morgenstern, "Demand Theory Reconsidered," *Quarterly Journal of Economics*, Vol. 62 (Feb. 1948) pp. 165-201.

or with modifications), or, (b) his expenditure plan has been modified and a new demand curve (which may or may not have the original shape) is set up which describes his immediate future intentions in the market under consideration. . . . An individual demand curve of one variable, then, no matter what its shape, is valid as it stands, only for *one single use* i.e. for one transaction."[7]

Special emphasis of some of the characteristics and properties of a consumer's demand curve for fluid milk based upon uniform or flat pricing is made to show that many of the properties become meaningless in considering pricing policies that involve price discrimination. In considering discriminatory pricing it is assumed that the demand curve has not been reconstituted in terms of Morgenstern's requirements. Instead, an inquiry will be made into what modifications or changes take place in the original demand curve. If the demand curve is not reconstituted, the portion of the demand curve below the point where a transaction is made must be greatly modified. Some explanation as to the modification that must be made in the demand curve predicated upon flat pricing below the point where a transaction takes place is needed for determining the feasibility of quantity price discrimination.

A Two-Price System of Pricing

With the indifference curve used in Figure 1a it is interesting to draw a hypothetical demand curve that might be faced by a milk dealer practicing a two price system of price discrimination Figure 2a & 2b).[8]

Suppose that in this case milk was sold on a flat price basis of 25 cents per quart. This opportunity to the consumer is shown by a price outlay line similar to the one in Figure 1a. At a flat price of 25 cents per quart, indicated by price line PQ, it was found that with the indifference curves as shown, the individual would purchase the quantity OF of milk. After this purchase is made, suppose a policy of price discrimination were practiced and the consumer were offered the opportunity of purchasing additional quantities of milk at a price of 20 cents per quart. Starting from the point of tangency with indifference curve II and price line PQ at point E, a price line (dotted line EJ) corresponding to a price of 20 cents per quart can be drawn which shows the new opportunity line. This line has exactly the same slope as PG which corresponds to a price of 20 cents per quart under flat pricing. This new 20 cent discriminating price line

[7] Ibid., p. 171.

[8] A schedule for the case of perfect price discrimination could be derived from the indifference map. It would set the limit to the maximum amount of money that a seller could extract from a consumer for any given quantity. This schedule would be predicated upon substitution effects alone since it is assumed that the individual would be held to a given indifference curve. For a more detailed treatment of this point see Kenneth E. Boulding, *Economic Analysis*, New York, Harper and Brothers Publishers, 1948, and the writer's dissertation for the doctorate.

is tangent to an indifference curve at J which corresponds to a total quantity of milk taken, indicated by OM for the two-price system.

This arrangement would mean that after the equilibrium position is reached at E, with flat pricing at 25 cents per quart, an additional quantity of milk indicated by FM could be sold to the consumer through quan-

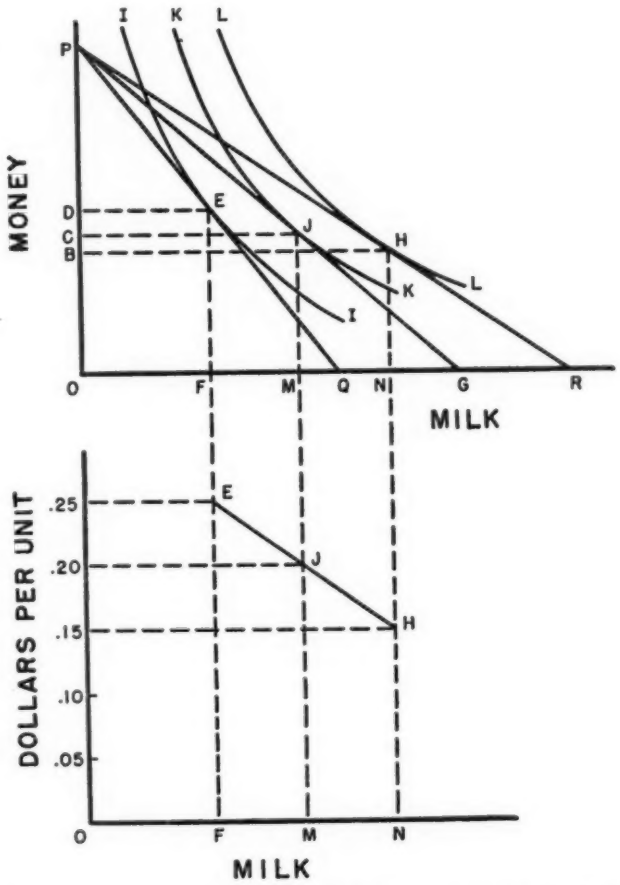

FIGURE 1A (TOP) AND 1B. DERIVATION OF A CONSUMER'S DEMAND CURVE UNDER UNIFORM PRICING

tity price discrimination at 20 cents per quart. For theoretical purposes a three price quantity price discrimination pattern could be set up which could be shown by a price line extending from point J with a slope corresponding to a lower price (assume 15 cents per quart) which would be tangent to a higher indifference curve. (Not shown in Figure 2a.)

As in Figure 1b, this new demand curve can be plotted as a schedule

showing the relationship between this particular pattern of pricing and the quantities that would be taken (Figure 2b). For comparative purposes on this same diagram a broken line is used to show the demand curve derived in Figure 1b (EE).

As a starting point for the case of imperfect quantity price discrimina-

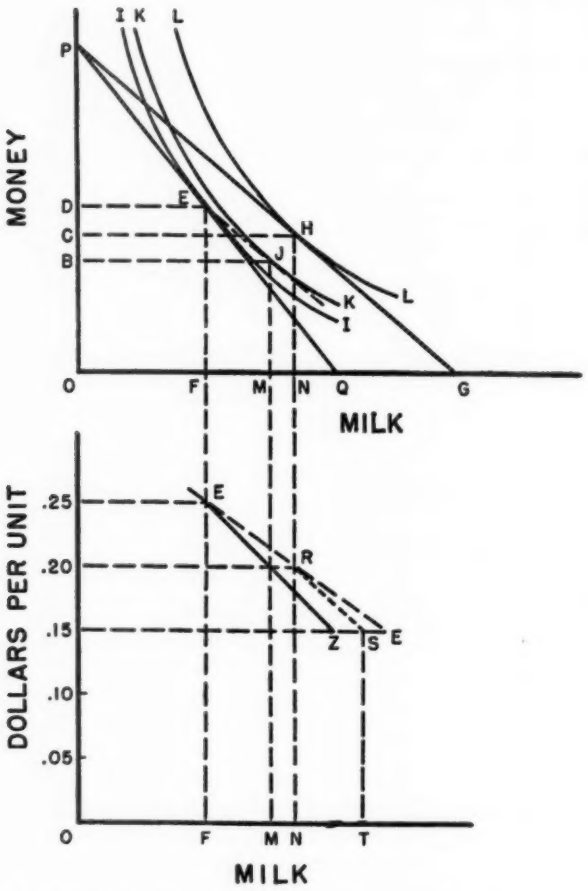

FIGURE 2A (TOP) AND 2B. DERIVATION OF A CONSUMER'S DEMAND CURVE UNDER A TWO PRICE SYSTEM OF DISCRIMINATION

tion, uniform pricing at 25 cents per quart was assumed which suggests that the consumer had the opportunity of purchasing all the milk desired at that price. This same assumption was implied for the demand curve derived in Figure 1b, therefore, the two curves have a common point at a price of 25 cents. From here on, the curve based upon this particular pattern of price discrimination (EZ) becomes steeper than curve EE. The

amount of divergence after price discrimination enters in, indicates the effectiveness of the income effect from flat pricing upon quantity taken at a particular price. A wide divergence between the two curves would be indicative of the fact that the quasi-increase in income from flat pricing is a strong incentive for the consumer to purchase more milk.

It should be emphasized that the discriminatory curve will diverge from the regular demand curve (EE) at the price where discrimination begins and will take a given course depending upon the pattern of discrimination. Each point along demand curve (EE) could be the origin of a discriminatory curve similar to EZ. For example, if a two price plan called for selling regular milk at 20 cents per quart and surplus milk at 15 cents per quart, then RS becomes the applicable discriminatory curve instead of EZ. In other words, under this two price system quantity ON of milk would be sold at the regular price of 20 cents per quart and NT would be sold at the discriminatory price. Both prices of a two price plan would be variable. Each base price would have a corresponding schedule of base milk. Each surplus price would have a corresponding schedule of surplus milk depending upon the base price and the surplus price that was adopted.

A two price system of intra-consumer quantity price discrimination, then, involves locating two points—one on the curve which holds for flat pricing at the higher price and one that applies to the quantity and price for the lower discriminatory price. If after the consumer had reached an equilibrium point at 25 cents per quart, quantity price discrimination was initiated at 15 cents per quart rather than 20 cents per quart additional substitution and income effects would prompt the consumer to purchase more milk. In other words a seller has considerable latitude in adjusting his business to meet his particular circumstances if he can practice discriminatory pricing. Demand becomes even more manipulative than the alternatives that are suggested with flat pricing and conditions of imperfect competition.

Price Elasticity of Demand and a Two-Price System

Some broad generalizations about pricing policies and patterns are warranted from the indifference curve technique in the elastic and inelastic cases. The elastic case for fluid milk is shown in Figure 3. The indifference curves are drawn to illustrate the case where the price elasticity of demand for fluid milk is elastic. The indifference curves under such a situation are very flat indicating that income and milk are good substitutes for each other. The slope of the price line PQ is assumed to represent the price of milk before the price change. An equilibrium position is reached at point E. At this position PD income is given up and the quantity of milk purchased for this income is indicated by OF.

Suppose now, that the price of milk is reduced on a flat price basis to a price indicated by line PG. The new price line PG is tangent to indifference curve LL at point H. In this case because of the fall in the price of milk, total expenditures are increased from PD to PC or by DC and the quantity of milk purchased is increased from OF to ON or by FN. With this given scale of preference and under the price relationships shown, the price elasticity of demand for milk is relatively elastic.

The consumer is on a higher indifference curve, LL instead of II. To

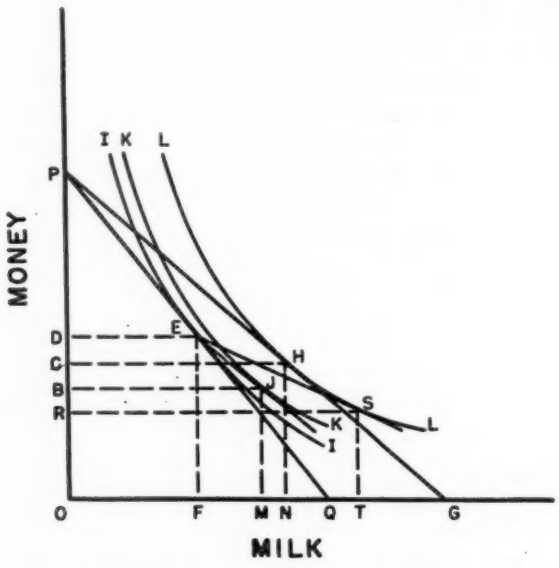

FIGURE 3. INDIFFERENCE CURVE ANALYSIS WHEN THE PRICE ELASTICITY OF DEMAND IS ELASTIC

attain that position, he purchased an additional quantity and increased his total expenditure for milk. This situation is acceptable to the consumer since he is on a higher indifference curve.

The question that needs to be answered is what would the results be if quantity price discrimination were practiced. The answer, of course, depends upon the pattern of discriminatory pricing. If it is assumed in Figure 3 that price discrimination is initiated after the equilibrium position of E is attained, then for comparative purposes a price line (EJ) parallel to PG can be drawn from point E. This line is tangent to an indifference curve KK at point J. This would mean that under this pricing policy the consumer would increase his purchase of milk from OF to OM or by FM.

A comparison between a flat price reduction from the price indicated

by line PQ to PG and a reduction in price involving quantity price discrimination at the same price can now be made. The consumer would be on a higher indifference curve with flat pricing. He would decrease his expenditure (DC compared to DB) and the quantity of milk would be considerably increased (FN as compared to FM). Under this particular pricing pattern the consumer would definitely prefer a flat price reduction.

The dealer's or the industry's position can also be summarized. If the marginal revenue (DC) produced by selling quantity FN is greater than the marginal cost of producing and selling FN, then position H is a desirable position for the industry. However, if position E is profitable while H is not, then as long as the marginal revenue DB is greater than the added cost of producing and selling FM, position J is preferable to E for the dairy industry. It is possible that J could be a profitable position while H is unprofitable. The revenue received from the consumer represented by DB for the purchase of quantity FM is much greater than the revenue represented by DC for the purchase of a greater quantity FN.

The above results suggest the point that if the demand curve for milk for a particular family were elastic, there might be cases where it would be profitable for the industry to attempt a program of increasing sales through a two price plan, where a policy of flat price reduction would be unprofitable. If quantity price discrimination can be accomplished without too great a cost to the industry both in terms of mechanics of a particular scheme, as well as loss of goodwill on the part of the consumer, circumstances are very possible where quantity price discrimination would offer advantages to both the consumer and the industry.

It can be shown that certain patterns of quantity price discrimination can allow as much or more income effects than those offered to the consumer under the pattern of flat price reduction indicated in Figure 3, but never as much as if there had been a flat price equal to the weighted average of the discriminatory prices. This can be shown by drawing a line (ES) tangent to indifference curve LL and connecting point E. Price line ES represents a considerable reduction in price as compared to price line PG.

In this case both a flat price reduction and discriminatory pricing are equally acceptable to the consumer, since they place him on the same indifference curve. One important point should be noticed, however. Even though in this case the income effects are comparable, the substitution effects indicate that the consumer would be willing to take a greater quantity of milk under the two price plan. This is shown by comparing FN with FT. Any line flatter than ES would allow a greater income effect than alternatives shown by price line PG or ES as long as it started at

point E. This point merely indicates that in some circumstances income and substitution effects can be considerable under price discrimination.

The Inelastic Case

Figure 4 is the case where the price elasticity of demand is inelastic. The indifference curves are not nearly so flat as in Figure 3, which produces the result that a considerable reduction in the price of milk leads to a small increase in the quantity purchased.

The general requirements for the inelastic case are that although the

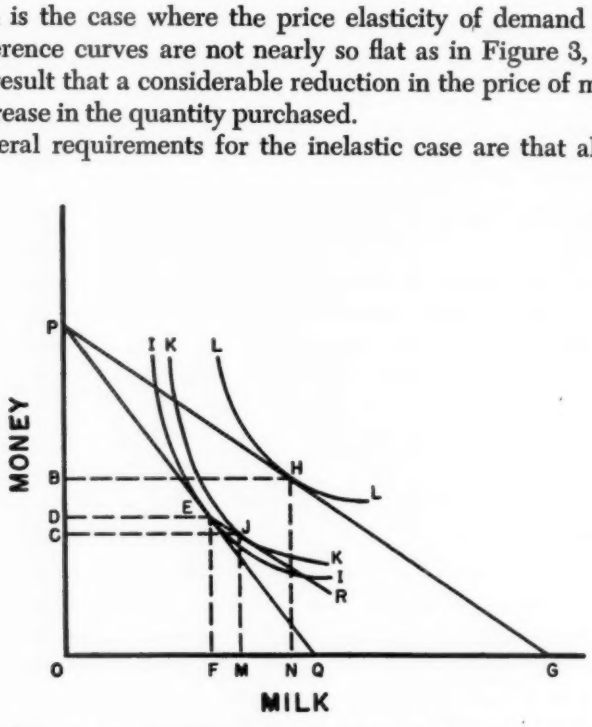

FIGURE 4. INDIFFERENCE CURVE ANALYSIS WHEN THE PRICE ELASTICITY OF DEMAND IS INELASTIC

total quantity of milk taken increases, the total expenditure on the part of the consumer decreases with a fall in the price of milk. This can be seen in Figure 4. Position E indicates an equilibrium point where PD indicates the amount of income given up for the purchase of the quantity of milk shown by OF. If the price of milk is lowered to a price indicated by PG, the new equilibrium position is reached at H. At this point it can be seen that because of the flat price reduction, the consumer has increased his consumption of milk from OF to ON or by FN. Expenditures on the other hand have decreased from PD to PB or by an amount equal to BD. In other words, the increased quantity taken has not been sufficient enough to compensate for the fall in price and total expenditures have decreased.

Suppose now that after the equilibrium position at E is reached, a

policy of quantity price discrimination is initiated. Let the price charged for the additional quantity sold be equal to the price represented by price line PG. This is shown by price line ER, which is parallel to PG. It is tangent to indifference curve KK at J. At this equilibrium position with this pattern of discrimination, the quantity of milk taken has increased from OF to OM or by FM, and the expenditure has increased from PD to PC or by DC. Other variations are possible depending upon the reduced discriminatory price.

It should be emphasized that, if a two price plan does not adversely affect sales at the regular price, total revenue is always increased by selling additional milk at a discounted price. Marginal revenue will not be negative as it is with a flat price reduction in the inelastic case. A two price plan in effect would make price reductions possible on surplus milk without changing the price or quantity of milk normally sold at the regular price. The additional revenue received from the surplus milk would be available to cover the cost of handling and marketing this milk. As long as this marginal revenue is greater than marginal cost, the industry could profit by selling the surplus milk under a two price plan. The fact that marginal revenue is negative in the inelastic case and positive under a two price plan may present some real opportunities to the dairy industry to use two price techniques as a means of increasing consumption of milk.

An obvious generalization when the price elasticity of demand is inelastic is that it is never profitable for an industry to reduce price on a flat basis in an attempt to increase quantities sold. Some costs are always involved in making these quantities available and there is no payment to cover these additional costs since total revenue is decreased. If an industry or firm faced with inelastic demand has any control over its pricing policy, it will never decrease price on a flat basis in order to sell additional quantities of the commodity. If it does not have control over its pricing policy, the incentive is present to do all in its power to gain control.

As far as the consumer is concerned a flat price reduction is very likely to place the consumer on a higher indifference curve unless the comparison is made for a flat price reduction that is small with a considerable price reduction on a discriminatory basis. It is possible, if the indifference curve does not bend too much, that quantity price discrimination at low prices could place the consumer on as high an indifference curve as a moderate flat price reduction.

In reference to the dairy industry, most individuals concerned with marketing of fluid milk maintain that the price elasticity of demand for most families is relatively inelastic. If this is true, and there are many

empirical data to indicate that it is true, then a policy of holding the price in spite of seasonal fluctuations in production is justified from an industry point of view. If the industry does maintain its price, then the consumer is in the most unfavorable circumstance of the three alternative positions. Either a flat price reduction or a price reduction on a discriminatory basis is preferable for the consumer to a policy of retail price maintenance. This statement is true for either the elastic or inelastic case.

It should be emphasized, however, that any two-price system of quantity price discrimination has little chance for success unless the spread between the two prices is great enough to allow considerable income and substitution effects. This is especially true in the inelastic case.

Summary

The theoretical framework as developed by this paper is suggestive rather than definitive. It has been the purpose of this study to develop a conceptual framework that might be used to analyze some of the theoretical aspects of pricing policies pertaining to intra-consumer price discrimination in the sale of fluid milk. Although the analysis has been confined to pricing policies for fluid milk the results also apply to such merchandising practices as two for one sales, one cent sales, multiple pricing and other pricing techniques involving intra-consumer quantity discrimination.

The results show that pricing policies involving intra-consumer discrimination may increase the welfare of consumers in comparison to some generally accepted uniform pricing policies. It is granted that quantity price discrimination involves monopolistic practices. The analysis reveals, however, that discriminatory pricing may be a closer approximation of a "competitive" or "free" market than is now the case in many markets practicing a policy of retail price maintenance for fluid milk during periods of flush production.

In order for a two-price plan, as outlined in this paper, to be acceptable to producers and distributors plans must be devised which will prevent consumers from substituting milk which they purchased at the cheaper price for milk which they would have purchased at the regular price. Producers must be assured that surplus milk used in a discriminatory program would not affect adversely the amount of milk classified as class 1 or fluid milk sales. Within these general limitations it is possible for consumers, producers and distributors to receive some benefit from intra-consumer price discrimination. In other words, those groups or segments of the economy that can sanction or initiate a two-price plan for selling milk may be able to receive some gain from such a program.

USE OF REGRESSIONS AND TEST PROCEDURES*

FRED H. WIEGMANN
Louisiana State University

THE PROBLEM of determining from samples whether two or more populations are significantly different, in some characteristic, is a relatively common one in research in agricultural economics and other social sciences. Usually when two groups of data are of interest they are reduced to means and "students t" test is used to determine, at some chosen level of probability, whether the groups are significantly different for the characteristic being studied. When more than two groups are concerned analysis of variance and the "F" test provides a similar method of testing whether observed differences, in means, are significant or could have arisen from chance error.

Much of the data of agricultural economics and other social sciences is subject to analysis by simple regression and this method has been a favorite analytical procedure for many years. Generally, the problem of interest has been to determine whether regression was or was not present and the usual test was for the significance of the regression coefficient "b." The comparison of two or more regressions by testing for significance of differences between them does not seem to be a common empirical practice in research in agricultural economics.[1]

Moreover, where regressions have been tested for differences those tests seem to extend no further than a test for differences in the "b" coefficients. Provided interest is only in whether the "b" values differ this procedure is perfectly sound. But it may be suggested that additional information could be secured from the sample (in regression analysis) which will result in more information about the populations and perhaps even result in different conclusions than might otherwise be made.

This paper is a further development of ideas concerning tests for significance of differences between regressions and is based on a study in which such tests formed a basic tool.[2] This paper presents the procedure

* The author wishes to acknowledge the helpful criticism and assistance given by Earl Kehrberg, Purdue University and Emil Jebe and Earl O. Heady, Iowa State College.

[1] This does not ignore the fact that comparison by analysis of variance of means, of data subject to regression, has been used. What seems to be lacking in these cases, however, is recognition of the possibility that such a test may not alone be sufficient to establish difference or similarity in the groups. This is because the individual total regressions are made up of a series of groups (or strata) and the differences may become more or less significant from one strata to another. There are other limitations as discussed later.

[2] "Comparison of Costs of Service and Self-Service Methods of Selling Meat in Retail Food Stores," a Ph.D. dissertation submitted to the Graduate Faculty of Iowa State College, June 1953, by the author.

briefly along with some of its limitations and implications. The major purpose, however, is to suggest its applicability to other research in agricultural economics and to open this area for further discussion. It will be assumed at the outset that the nature of "t" and "F" tests and simple regression techniques, as usually employed, are already familiar to the reader.

The Problem

Conceptually, the problem is to test whether two populations are different in some characteristic, when the sample data have been summarized by simple regression. Examples from the empirical study noted above will be used for illustration. In this study the regressions of various cost factors on size of business were computed for service and self-service types of meat departments. The empirical results for one variable, the regression of equipment investment on sales, are shown in Table 1 and Figure 1.

TABLE 1. SUMMARY OF ANALYSES OF REGRESSIONS OF EQUIPMENT INVESTMENT ON SALES[a]

Method of operation	"a"	"b"	r^2	F	$s^2_{y \cdot x}$
Service	2.418610	.454787	.71	58**	.012506
Self-service	2.452846	.468601	.81	90**	.003492

[a] The original data were transformed to logarithms in this case. The "a" 's are the constants and "b" 's the coefficients of regression. The asterisks (**) denote highly significant regression (at the 1% level of probability). $s^2_{y \cdot x}$ is a measure of the variation about regression.

A function of the form $Y = a\ x^b$ was fitted to the data in this case so the constants, regression co-efficients and variances are shown in logarithmic terms in Table 1. The regression model in this case was in $Y = \ln a + b \ln x + \varepsilon$, where ε is $N(O, \sigma^2)$.

It can be observed that some difference exists between the sample measures ("a," "b," $s^2_{y.x}$) which is also evident from Figure 1 in the curves of average relationship. The problem is to test whether the two populations are statistically different in the investment characteristic by testing various measures for significant differences. A procedure for testing differences in specific measures, $\overline{Y}$, "a," "b," and $\hat{Y}$ can be found in several statistical texts.[3] However, the presentations in many texts lack sufficient interpretation and discussion of the numerous implications (and complications)

[3] Palmer O. Johnson, *Statistical Methods in Research*, Prentice Hall, N.Y., 1949, chapters 4 and 5. Cyril H. Goulden, *Methods of Statistical Analysis*, John Wiley & Sons, N.Y., 2nd Ed., 1952, chapter 4. George W. Snedecor, *Statistical Methods*, Iowa State College Press, Ames, Iowa, 4th Ed., 1946. Alexander M. Mood, *Introduction to the Theory of Statistics*, McGraw-Hill Book Co., Inc., New York, 1950. Especially Sec. 13.2 and 13.3.

$\overline{Y}$ is the mean of the dependent variable. $\hat{Y}$ is the estimated value of Y (regression Y) for any given value of X.

that one encounters in empirical use, particularly in terms of the relationships between the tests.

The hypotheses tested here were null hypotheses of the form $H_1 : a_1 = a_2$, $H_2 : b_1 = b_2$, and $H_3 : Y_1 = Y_2$ where, in each case, t = the ratio of the difference to its standard error. For example, $t = \frac{a_1 - a_2}{s_{a_1 - a_2}}$ These tests show, at some chosen level of probability, whether the dif-

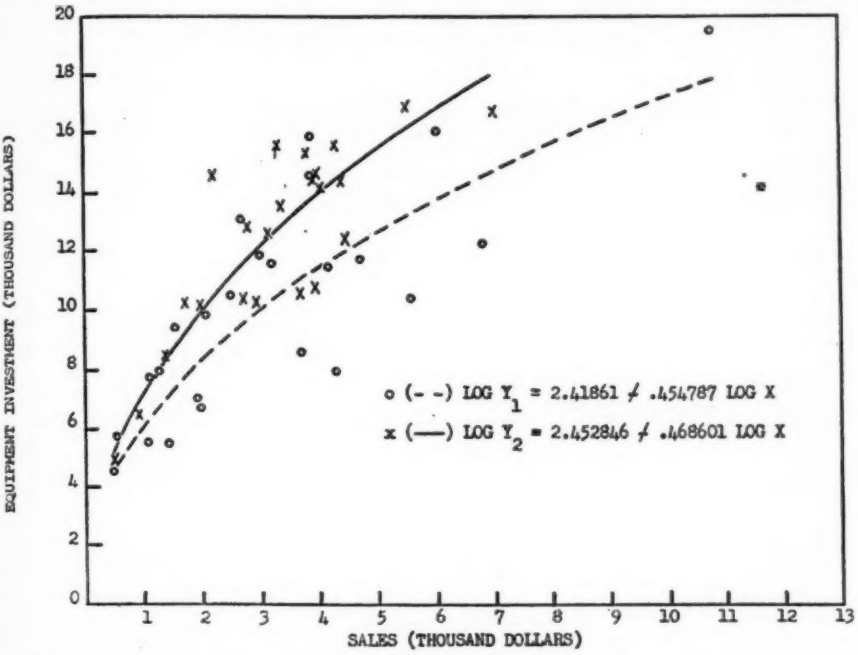

FIGURE 1. RELATIONSHIP OF EQUIPMENT INVESTMENT TO MEAT DEPARTMENT SALES FOR ONE WEEK

ference being tested is due to chance alone or is an indication of real difference in the population. The usual 5% (significant) and 1% (highly significant) levels of probability were used in these tests.[4]

[4] Specific formulas for t vary depending on the sample difference being tested and on whether the F test for homogeneity is significant or not (Table 2). For example; where F is not significant variances are pooled and for $H_1 : a_1 = a_2$ then

$$t = \frac{a_1 - a_2}{\sqrt{s_p^2\left[\left(\frac{1}{n_1} + \frac{\bar{X}_1^2}{Sx_1^2}\right) + \left(\frac{1}{n_2} + \frac{\bar{X}_2^2}{Sx_2^2}\right)\right]}}$$

where s^2_p = the pooled variances and Sx^2_1 = the corrected sum of squares. Where F is significant variances are not pooled and it may be necessary to calculate an "adjusted t" value. This, in effect, decreases the chance of asserting a difference where there is none. Footnote 3; Snedecor, p. 82-83 and Johnson, Chap. IV and V.

The results of the tests for the regressions shown in Figure 1 and Table 1 are shown in Table 2. Although individual differences $a_1 - a_2$ and $b_1 - b_2$ are not significantly different the difference $\hat{Y}_1 - \hat{Y}_2$ at $X = 3401$ was highly significant, and, at $X = 5000$ significant. At first glance the results of the tests appear to be in conflict, thus making interpretation difficult. However, this is not true. We touch briefly upon this below: (1) The co-efficient "b" is a measure of slope. Thus, the two regressions could be extremely far apart and the b's could still be not significantly different. (2) The co-efficient "a" is an extension of $\hat{Y}$ to the X axis ("a" = $\hat{Y}$ at $X = 0$).[5] It has been shown that the best estimate of

TABLE 2. SUMMARY OF TESTS FOR HOMOGENEITY OF VARIANCE AND SIGNIFICANCE OF DIFFERENCES BETWEEN REGRESSIONS OF EQUIPMENT INVESTMENT ON SALES[a]

Homogeneity	Significance of differences			
	Value of "t"			
F	$a_1 - a_2$	$b_1 - b_2$	$\hat{Y}_1 - \hat{Y}_2$ at:	
			X=3401	X=5000
3.58*	.123	.178	2.83**	2.59*

[a] F is a pre-test for homogeneity of variances to see if the variances can be pooled (Snedecor, Sec. 10:13, P. 249 and P. 76). When F is significant (5% level of probability) the variances are not pooled. X=3401 is an average of $\overline{X}_1$ and $\overline{X}_2$ which were practically the same. X=5000 was an arbitrary choice of X about midway between the means of X and the upper extreme of available data.

Y is made where $X = \overline{X}$.[6] Thus the estimate of Y at $X = 3401$ is a better estimate of $\hat{Y}$ than at $X = 1$. However, the highly significant difference ($\hat{Y}_1 - \hat{Y}_2$ at $X = 3401$) does not mean this test is more accurate, even though it is based on better estimates of the two Y values, than the test of $a_1 - a_2$ (or $\hat{Y}_1 - \hat{Y}_2$ at $X = 1$). This is because the tests take these differences in accuracy of estimation into account. The same is true for $\hat{Y}_1 - \hat{Y}_2$ at $X = 5000$. (3) The tests are essentially supplementary in nature—each test is for a specific difference. A test that does not indicate a significant difference is not in conflict with another that does even when they are testing for difference in the same characteristic. (4) There may be sufficient difference in the sensitivity of the tests to vary in their ability to detect actual differences. The nonsignificant difference $b_1 - b_2$ could mean there was no difference in the b's, or it could mean the difference

[5] This refers to natural numbers. In the particular case illustrated, however, it is necessary to designate "a" = $\hat{Y}$ at $X = 1$ (where $\log X = 0$) since if $X = 0$, $\log X = -\infty$.

[6] Ostle's mimeographed notes for Statistics 401-402, Iowa State College, 1950, Dr. B. Ostle, now at Montana State College.

was so small the test could not detect it at an acceptable level of significance with this size sample. (5) The significant differences between the Ŷ's neither prove nor disprove a difference in the b's. They yield additional information about the population and tend in this case to support at least the possibility of a small difference in the b's. (6) From a practical viewpoint general observation would suggest that the investment for equipment under self-service is different and higher than under the service method since more display cases are needed for a particular sales volume while other equipment remains practically constant.

Various other regressions were also computed and differences between the regressions were similarly tested for significance. The results of these tests are summarized in Table 3. In several cases, the tests are unanimous

TABLE 3. SUMMARY OF TESTS FOR SIGNIFICANCE OF DIFFERENCE BETWEEN REGRESSIONS[a]

Relationship (Regression)	Significance of differences (Values of "t")			
	a_1-a_2	b_1-b_2	$\hat{Y}_1-\hat{Y}_2$ at:	
			X=3401	X=5000
1. Labor hours on sales	1.720	3.26[xx]	2.56[x]	2.02[x]
2. Total labor cost on sales	.890	.252	2.32[x]	1.90
3. Equipment investment on sales[b]	.123	.178	2.83[xx]	2.59[x]
4. Market space on sales	.070	.117	.529	.368
5. Total cost of paper supplies on sales	.332	1.810	4.35[xx]	4.37[xx]
6. Combined costs on sales	.637	.999	.556	1.02

[a] Regressions 3 and 4 were of the form $Y=aX^b$. The remainder were in simple linear form.
[b] Discussed in the text and shown separately in Table 2.
[x] Denotes significant difference—at the 5% level of probability.
[xx] Denotes highly significant difference—at the 1% level of probability.

in supporting the null hypothesis. But in other instances the individual tests indicate there are specific differences in the two populations just as in the case of equipment investment discussed above.

Interpretation of the Tests

The discussion above raises several questions. Is it sufficient, in comparing regressions (or data subject to regression), to test the differences in b values alone for evidence of differences in the populations, or of the a's alone, or of a's and b's alone?

Consider some of the cases noted in Table 3 where the "t" values for differences in a's and b's were not significant. Based on these two tests alone the statistical inference would be made that there was no difference between the populations, for example, in total paper cost. But such a conclusion would have been in error in terms of other specific differences as indicated by tests of differences in certain of the Ŷ values and by the

observation, during the course of the survey, of what went into these data (i.e. observations in the field that give a logical basis for particular conclusions apart from those indicated by the statistical tests).

Consider a case where grouped data are compared (without regression analysis) by testing the differences in the means alone ($\overline{Y}_1 - \overline{Y}_2$). Suppose the resulting "t" is not significant. A broad statement might be made that these populations are alike. A regression analysis and tests of the dif-

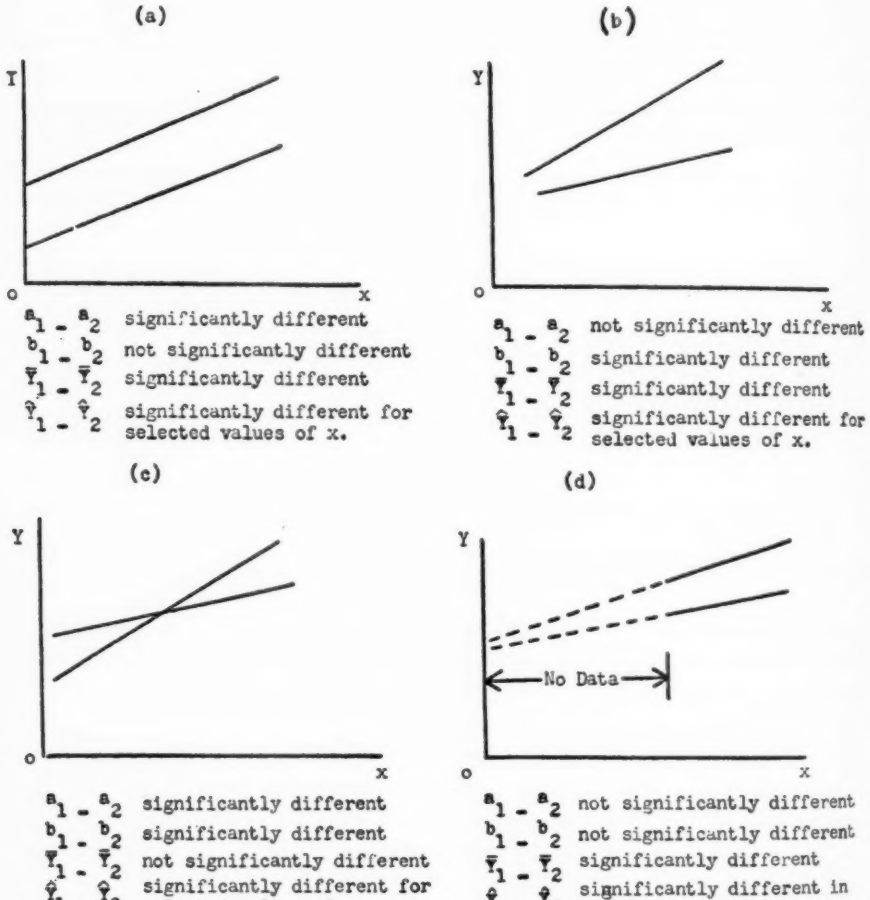

FIGURE 2. SEVERAL CASES ILLUSTRATING THE SUPPLEMENTARY NATURE OF TESTS FOR SIGNIFICANCE OF DIFFERENCES AND SHOWING THE DIFFERENT CONCLUSIONS THAT MIGHT BE ARRIVED AT CONCERNING THE SAME POPULATIONS.*

* The diagrams refer to population parameters. The differences refer to possible test results from sample observations.

ferences in the "b" and selected $\hat{Y}$ values might lead to different conclusions. The non-significant difference in means $(\overline{Y}_1 - \overline{Y}_2)$ might have occurred because the regressions crossed near the means $(\overline{Y})$. (See Figure 2 (c).) While the means may not differ the populations may differ considerably in terms of other parameters.

Another possibility, with respect to conclusions to be drawn from tests of the nature discussed above, may depend upon the range of the data being studied and the relationship between the range and confidence limits attached to estimates of the constants and co-efficients.[7] For example; two groups of farms from size 100 acres to 500 acres may be under study for some characteristic Y. The estimates of Y are most accurate where $X = \overline{X}$ (X = acres). On the basis of the whole range of X values certain conclusions may be drawn such as non-significant differences between $\hat{Y}$ values for the two groups at $X = 100$ and 400. However, if another investigator studied this characteristic only in the range 300 to 500 acres, where $\overline{X} = 400$, he might arrive at the opposite conclusion (for $X = 400$). It does seem apparent that conclusions, with respect to the characteristic under study, cannot be based on the statistical tests alone. Some logical basis for one's conclusion must come from a knowledge of the populations under study. The statistical tests here, as is generally true, are simply tools which provide a more definite basis for accepting or rejecting hypotheses relating to specified populations than would otherwise be possible. Other somewhat similar questions might be raised about the use and interpretation of these tests. As noted earlier the apparently few texts that do devote a few lines to these tests treat them very much on an individual basis, ignoring the relationship that must exist between them. Furthermore, little or no elaboration is made on needed refinements for particular situations or on interpretation, which is particularly difficult when their mechanics bring the tests into seeming conflict in results. Figure 2 illustrates a few of the cases in which the supplementary nature of the tests is apparent in showing different conclusions one might arrive at concerning the same populations. In tabular form these might be shown as the results in Table 3.

It should be mentioned that a difference that is statistically significant is not the same as an economically important difference. Whether a difference is economically important depends on criteria other than statistics. The tests could be used, however, to test null hypotheses such as $HO : \overline{X}_1 - \overline{X}_2 = K$ where K is some amount great enough to make a statistical difference between the means, regression co-efficients or other measures also important economically.

[7] *Ibid.*, chapter on regression.

Use of These Techniques

The comparison of regressions at all is not, it seems, very much in use in the social sciences. Despite the very prevalent use of both regression techniques and group comparisons the two seem not to have been brought together extensively in empirical studies. Thus, the tests discussed above also do not appear in empirical studies in agricultural economics. It is possible however, that comparisons of regressions by the method discussed may be justified for much wider use than has been true in the past.[8] Comparisons of groups of farms for various characteristics make up a large portion of research work in agricultural economics. It is suggested that the regression method may often offer more information about the groups than will simple averages, especially when tests for significant specific differences in the regressions are also used in the analysis. The regression technique and the tests are relatively simple to compute and well adapted to support underlying economic logic and practical observation. It would be helpful, however, if we had more information in text form about the refinements, relationships and empirical interpretations of the tests than are now available.

This technique would be particularly useful in agricultural economics, where problems involving size and technical innovation are always of interest. It would be useful in any study in which groups of data having certain common characteristics exhibit regression and it is desired to test whether the influence of other characteristics make the groups essentially different.

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[8] A very competent defense of regression methods has just recently been published. H. Wold and Lars Jureen. *Demand Analysis, A Study in Econometrics.* New York, Wiley and Sons, 1953.

SOME PHASES OF CONSUMER PREFERENCE AND DEMAND RESEARCH

L. D. Howell
Agricultural Marketing Service[*]

RESEARCH designed to obtain adequate and dependable information relating to the nature and characteristics of, and the factors that affect, the demand for specific agricultural products is greatly needed as a basis for adjusting the quantity and quality produced to consumer requirements. A basic function of marketing research is to supply such information. Maximum benefits to producers and to consumers from the results of such research would require timely adjustments in quantity, quality, suitability, and attractiveness of the products from the viewpoint of consumer preferences. Education of consumers regarding the quality and adaptability of the products and the contribution that improved products can make to a higher level of living would be needed. Increased efficiency in the entire chain of production, processing, manufacturing, and distribution processes would be necessary so that suitable products could be made readily available to consumers at attractive prices.

Problems involved in obtaining adequate and dependable information regarding consumer preferences and demand, as they relate to specific kinds of agricultural products, are complicated. But the need for such information for use as a basis for developing plans to fully utilize the results of research and other technological developments in adjusting the quantity, quality, adaptability, and attractiveness of these products to consumer requirements would appear to warrant considerable thought and experimentation concerning the development of suitable methodology. Different phases of the problem, such as factors that affect consumer preferences, income elasticity of consumer demand, and price elasticity of consumer demand probably would require different methods or techniques in order to get the best results.

One approach would be to examine the methods already tried out, or proposed, as a basis for indicating their possibilities and limitations and the changes needed. If these methods, with appropriate modifications, are found to be inadequate, new and more effective ones would need to be developed. Methods already tried out or proposed for obtaining information regarding consumers' preferences and demand, and factors affecting them include: (1) consumer preference surveys, designed to learn from consumers, through personal interviews, their preferences with respect to selected products and factors affecting these preferences; (2) consumer

[*] This paper is a personal contribution, not an official statement of the Department of Agriculture.

purchase surveys, designed to assemble data relating to volume of purchases and expenditures for specific articles by individuals and by families, to be used as a basis for indicating the response of volume of purchases and expenditures to individual incomes and to other factors; and (3) retail sales surveys, designed to assemble data as to volume of sales, prices, and other factors for specified products, which would show the response of volume of sales to prices and other factors. Some of the possibilities of and limitations to these methods are considered in the order listed.

Consumer Preference Surveys

One means, now in use, of finding out what consumers' preferences are and the factors affecting these preferences, as they relate to specific items, is to have trained enumerators interview a representative sample of consumers and obtain from each his replies to carefully prepared questions designed to elicit the desired information. The reliability of the information obtained by this method apparently depends to a considerable extent upon the questions asked, the skill of the enumerators, whether the consumers interviewed have the specific information desired and, if so, whether this information can be obtained from them in such form that it can be recorded, interpreted, and used to contribute to an understanding of the nature and characteristics of, and the factors affecting, consumer demand for specific agricultural products.

Information regarding the kinds of fibers women prefer in specified articles (such as house dresses, summer street dresses, slips, bedspreads, etc.) was obtained by asking representative women such questions, for example, as "Do you prefer cotton or rayon materials, or a mixture, for summer street dresses, or does it make any difference to you?"[1] This question appears simple and straightforward. The first impression may be that one who has had experience with these materials in such dresses could give a reasonably reliable answer that could be fairly accurately interpreted. Of more than 1,400 women who answered this question in 1947, about 28 percent expressed a preference for cotton and 28 percent for rayon; 32 percent expressed no preference; 7 percent expressed a preference for mixed fibers; and the preferences of 5 percent were not ascertained. If we assume that each woman interviewed was well informed regarding the qualities and characterictics of the various kinds of cotton and of rayon materials used in summer street dresses, which is perhaps

[1] *Women's Preferences Among Selected Textile Products.* U. S. Dept. Agr. Misc. Pub. 641, 124 pp., (1947). This is the first of a series of studies of consumer preferences relating to clothing, household textiles, and other non-food products and to potatoes, citrus, and other food products by the Bureau of Agricultural Economics. Improvements in methods have been made, but further refinements in methodology are needed.

more generous than the facts would warrant, what interpretation can be given to these data?

An interpretation of these data would need to take into account the fact that answers to such questions may be based upon any one of at least five conditions, assumptions, or frames of reference, as follows:

1. No differences in construction and finish of the fabrics; in construction, style, fit, etc., of the garments; or in prices and other factors than kinds and qualities of cotton and rayon materials used. Further, that various qualities of cotton and of rayon materials are used.
2. No differences in construction and finish of the fabrics; in construction, style, fit, etc., of the garments; or in prices and other factors than the kinds of fibers used. Further, that the original cotton and rayon materials used are of the same or comparable quality (whatever that may mean).
3. Differences, regardless of their extent, in quality of cotton and rayon fiber used; in construction and finish of the fabrics; in construction, style, fit, etc., of the garments; and in prices and other factors involved.
4. Knowledge and experience of the particular consumer with regard to street dresses made of cotton and those made of rayon, involving unknown differences in quality of the original fibers used; in construction and finish of the fibers; in construction, style, fit, etc., of the garments; and in prices and other factors involved.
5. Prevailing differences in quality and finish of fabrics; in construction, style, fit, etc., of garments; and in prices and other factors as they usually are encountered in retail stores

Answers given to such questions would doubtless be influenced, if not determined, by the assumptions or frames of reference on the basis of which the answers are given. In answering this question absolutely correctly, any informant might express a preference for cotton on the basis of one assumption, for rayon on the basis of another assumption, or for neither cotton nor rayon on the basis of still another assumption or frame of reference. Two informants with identical fiber preferences with regard to cotton and rayon for summer street dresses might correctly given opposite answers to such questions or two informants with directly opposite fiber preferences with regard to cotton and rayon summer street dresses might answer such questions correctly and in the same way, as a result of basing their answers on different assumptions or frames of reference. Furthermore, two informants with identical scales of values for the factors associated with cotton and with rayon used in summer street dresses might correctly give directly opposite answers to such questions when based on assumptions (3), (4), or (5) as listed above, because of

differences in factors other than those associated with cotton and rayon.

But assume, for analytical purposes, that all other factors than differences in quality of the cotton and rayon materials used in summer street dresses are held constant. Under these conditions would it be correct to assume that in answering this question each informant who expressed a preference for cotton materials would rather have a summer street dress made of cotton, regardless of how poor in quality this material might be, than to have a similar dress made of rayon, regardless of the quality of the rayon? And that those who indicated a preference for rayon would rather have a summer street dress made of rayon, regardless of how poor in quality the material might be, than to have a similar dress made of cotton, regardless of how high in quality that material might be? If not, the answer of any informant to such questions might be absolutely correct and express either a preference for cotton materials, a preference for rayon materials, or no preference for cotton or rayon materials, depending upon the qualities of cotton and of rayon materials the respondent had in mind at the time of giving the answer.

For purposes of illustration, assume that the qualities of cotton materials and of rayon materials used in summer street dresses were each graduated into 10 grades, beginning with one as the highest and ending with 10 as the lowest. If, at the time of answering this question, the informant had in mind grade one of cotton materials and grade 10 of rayon materials, she would be likely to express a preference for cotton; if instead she had in mind grade 10 of cotton materials and grade one of rayon materials, she probably would express a preference for rayon; but if she had in mind grade 5 of cotton and grade 5 of rayon, she might express no preference for either cotton or rayon. Apparently no satisfactory means have been devised for ascertaining what qualities of cotton and of rayon materials the informants had in mind at the time of giving their answers to such questions.

Then it would appear that, even if all factors, other than quality of the cotton and rayon materials used were held constant, similar answers to such questions could not be relied upon to reflect similar fiber preferences, and different answers could not be relied upon to reflect differences in fiber preferences. Addition of other variable such as prices, construction of fabrics, construction of garments, and style, all of which may actually be involved, would add to the complications in geometric proportions.

Further limits might be imposed by assuming that all factors other than cotton and rayon materials used are held constant and that the answers are specifically limited to items made of comparable, similar, or equal qualities of cotton and of rayon materials. Such an assumption might be so highly artificial that even if fairly accurate answers could be obtained, they might have limited usefulness for indicating fiber preferences under actual

market conditions. Furthermore, it might be difficult, if not impossible, for even the experts to agree as to the qualities of rayon materials that are comparable, similar, or equal to specified qualities of cotton materials. But even if the experts were able to agree on a specified quality of rayon material that was equal or approximately equal in every respect to a specified quality of cotton material, it might not be reasonable to expect even the best-informed consumer to have had enough experience with summer street dresses made of these particular qualities of cotton and rayon materials to enable them to give a reliable answer with regard to their fiber preferences on this basis.

But the assumption that consumers with experience know their fiber preferences in such a way that they can supply reliable information regarding them in response to such questions may not be well founded. An example may serve to illustrate the problems involved. I am a consumer who has had considerable experience with both cotton and rayon business shirts. At one time I went to buy cotton shirts but instead bought rayon shirts at substantially higher prices than I would have had to pay for *certain* cotton shirts available. I am not aware of any difference in style, workmanship, or fit, of the cotton and rayon shirts available. The rayon shirts purchased were not of the color most desired, whereas cotton shirts of the color most preferred were available at lower prices than I paid for the rayon shirts. But the quality of the fabrics used in the rayon shirts bought was considered much superior to the fabrics used in the cotton shirts considered. At another time I bought cotton shirts and paid substantially higher prices than I would have had to pay for *certain* rayon shirts available. Again I am not aware of any differences in style, workmanship, or fit, and both cotton and rayon shirts were available in the colors most desired. But the quality of the fabrics used in the cotton shirts purchased was considered much superior to the fabrics used in the rayon shirts considered. So far I have no reason to regret my choices and so far as I can tell I would likely make the same kind of choices again. But I have a vague idea that, in general, I prefer cotton to rayon for business shirts.

Under such conditions, what answers could anyone give to such questions as "Do you prefer cotton or rayon for business shirts or does it make any difference to you?" If I were approached "cold", I probably would say that *in general* I prefer cotton to rayon for business shrits. But what significance would such an answer have when I do not select and buy shirts *in general*? Perhaps the best answer available under these conditions would be that *certain* cotton shirts are decidedly preferred to *certain* rayon shirts, that *certain* rayon shirts are decidedly preferred to *certain* cotton shirts, and that *certain* cotton shirts and *certain* rayon shirts are considered about equally desirable. Such answers may be of limited usefulness for indicating

fiber preferences of consumers for business shirts, but can anyone reasonably expect better answers to such questions under such conditions? Similar difficulties would be involved in obtaining reliable and useful information in response to similar questions regarding any two or more materials or factors, each with variations in quality, etc., and for which the poorest quality, etc., of one is not preferable to the best quality, etc., of the other. Then what significance can one attach to expressions of preferences in reply to such questions under such conditions?

Similar difficulties may be involved in connection with attempts to obtain information regarding the chief factors that affect the decision to buy specified articles. Attempts have been made to obtain information regarding the most important things consumers look for in buying particular products (such as housedresses, summer street dresses, pajamas, slips, bedspreads etc.), by interviewing representative consumers and asking them such questions, for example, as "What are the most important things you look for in buying a summer street dress?" This question also appears fairly simple and straightforward and the first impression may be that one who has had experience in purchasing such items could give a reasonably reliable answer that could be fairly accurately interpreted. The factors taken into account might include style, durability, construction, price, launderability, comfort, etc. Answers to such questions would of necessity relate to differences in the factors involved, for obviously if there were no differences in style, durability, price, etc., these factors could have no influence on the choice of a summer street dress.

Differences in a number of factors usually are so great (for example, garments may be too large or too small, prices may be out of reach, styles may be out of date, etc.) as to absolutely prohibit the selection and purchase of some particular items. These extreme items may be ruled out of consideration in the beginning as being without the range of choice. The amounts of differences required to be prohibitory for specific items would doubtless vary considerably from one consumer to another. But can it be assumed that informants know that such extreme differences are of equal importance in selecting and buying a summer street dress because each, by definition, is absolutely prohibitory, and further that these items should head the list of "most important things looked for" in buying a summer street dress? If not, how can the answers be interpreted in such a way as to compare one answer with another?

To interpret and compare answers given by informants that style, for example, is the most important thing looked for in buying a summer street dress, it would appear necessary to know whether such answers mean that differences in style, no matter how small, are more important in deciding which dress to buy than differences in any other factors (such as, for ex-

ample, durability, size, fit, price, etc.) regardless of how large these differences may be. If not, two informants with identical differences in relative importance attached to differences in style and in durability, for example, might give directly opposite answers to the question, "What are the most important things you look for in buying a summer street dress?", because one informant had in mind wide differences in style and small differences in durability, whereas the other had in mind small differences in style and large differences in durability. On the other hand, two informants with wide differences in relative importance attached to specified amounts of differences in these factors might give similar answers to this question because the informants did not have in mind at the time of giving the answer the same amounts of differences in the factors considered. Then, in order to interpret the answers given to such questions, from the viewpoint of the relative importance of such factors as style, durability, price, etc., in selecting summer street dresses, it would appear necessary to know that each informant answered on the basis of the same frame of reference or had in mind at the time of giving the answer the same sets of differences in factors involved. In the absence of having the same frame of reference, it might be helpful to know for each informant how much difference in the factor considered most important is considered equivalent to or greater than specified differences in each other factor considered, along with information as to the range of differences in the factors involved.

Other possibilities could be multiplied at length but those already given may serve to indicate the difficulties involved in interpreting the significance of answers to such questions, for example, as "Do you prefer cotton or rayon for summer street dresses or does it make any difference to you?" and "What are the most important things you look for in buying a summer street dress?" without having for each informant the specific assumption or frame of reference upon the basis of which the answers are given. These difficulties would be involved regardless of the survey method used and of the skill of the interviewers, and even if all consumers interviewed were thoroughly informed regarding these matters and based their answers on well-balanced judgements. The probability that some consumers may not be well informed or that some may give careless answers, obviously does not help the situation.

The same or similar difficulties may be involved in interpreting answers relating to reasons for preferring one kind, size, quality, etc. of product to another; to the relative amounts of attention given to price, size, quality, etc. and possibly to other types of information requested in studies relating to consumer preferences. Then what significance can be attached to answers to such questions? Do they contribute in an important way to an understanding of the nature and characteristics of, and the most im-

portant factors affecting, the demand for specific agricultural products? Are research workers justified or on solid ground in presenting the results of the tabulations of such answers, following a statement of the needs for, and usefulness of, information on the nature and characteristics of, and factors affecting, consumer demand for agricultural products, with the inference that these data supply the needed information or that they contribute in an important way toward meeting these needs?

It would appear that, if reliable information is to be obtained from consumers through answers to prepared questions relating, for example, to their fiber preferences for particular products; to the relative importance of quality, price, and other factors taken into account in deciding which item to buy; and possibly to other factors, some plan will have to be developed for obtaining reliable answers to appropriate questions from different informants based on the same assumptions or frames of reference which are so narrowly defined as to assure that similar answers to specified questions will reflect similar attitudes or reactions. A basic requirement would be that the questions be not ambiguous, vague, as indefinite.[2] Questions that are subject to two or more widely different interpretations obviously do not meet this basic requirement.

If such questions as, "Do you prefer cotton or rayon for summer street dresses, or does it make any difference to you?", are intended to elicit information as to the informants' choices of summer street dresses made of cotton or rayon, taking into account prevailing differences in quality and finish of the fabrics; in construction, style, fit, etc., of the garments; and in prices and other factors, as they are encountered in retail stores, the informants might be asked, for example, how many summer street dresses they bought during a specialized recent period, and then ask how many of them were made of cotton, how many were made of rayon, and how many were made of other materials. Answers to such questions would supply information with regard to the choices made by informants relating to summer street dresses made of cotton and rayon, under the conditions and alternatives available at the time, but they would not indicate the extent to which differences in materials used were responsible for the choices made. The dresses bought may have been much less desirable to the informants, and also much lower in prices, than other dresses available of the same or different materials.

Some indications with regard to the factors responsible for the choices made may be obtained from answers to questions designed to show how the dresses bought differed from others considered (made of the same or different materials) in quality, construction, and finish of the fabrics

[2] *Foundations of Psychology* edited by E. G. Boring, H. S. Langfeld and H. P. Weld, pp. 580f. (1948). *Psychology and Life* by F. L. Ruch, 3rd ed. pp. 671f. (1948).

used; in construction, style, fit, etc., of the garments; and in prices and other factors. Answers to such questions perhaps would indicate some of the factors taken into account in arriving at a choice of street dresses, but they may not supply a reliable bases for evaluating the relative importance attached to these factors in deciding which dresses to buy.

Without attempting to suggest other alternatives, it may be appropriate to emphasize the importance of formulating appropriate questions that are not ambiguous when developing plans for obtaining reliable information relating, for example, to consumers' fiber preferences for particular products. This may require some restrictions in the scope of consumer preference studies, care in the choices of, and specifications for, assumptions or frames of reference relating to each question, and adaption of questions to elicit the desired information under the conditions specified. The development of methodology appropriate to meet these requirements offers a challenge and an opportunity to research workers.

Consumer Purchases Survey

Information relating to consumer choices as reflected in actual purchases of specified kinds of articles under actual marketing conditions may be obtained by interviewing a representative sample of consumers and obtaining from them information as to the number of units purchased and the total expenditures made during specified periods for the specified items. Age, income, education, race, occupation, and place of residence, of the informants would need to be recorded so that the data relating to items purchased and to expenditures could be summarized on the basis of incomes and of various other groupings. Such surveys have been made by the Bureau of Human Nutrition and Home Economics, the Bureau of Labor Statistics, and other agencies, and apparently the results, particularly as they relate to consumer expenditures, are considered at least fairly satisfactory.[3]

For such information to be of maximum usefulness in indicating consumer preferences as they relate to specific kinds of items purchased, it would be necessary to assemble information to show the nature and variety of alternative choices available and the relative importance of the more important factors taken into account in making the decisions to buy. The

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[3] *Consumer Purchases Study—Family Food Consumption and Dietary Levels, Five Regions—Farm Series.* U. S. Department of Agriculture, Misc. Pub. 405, 393 pp., illus. (1941). *Urban and Village Series,* U. S. Department of Agriculture, Misc. Pub. 452, 268 pp., illus. (1941). *Family Income and Expenditures, Five Regions, Part 2, Family Expenditures. Urban and Village Series,* U. S. Department of Agriculture, Misc. Pub. 396, 410 pp., illus. (1940). *Farm Series,* U. S. Department of Agriculture, Misc. Pub. 465, 366 pp., illus. (1941). *Family Spending Saving in Wartime,* U. S. Department of Labor, Bureau of Labor Statistics, Bul. 822, 218 pp. (1945).

nature and varieties of alternatives taken into account may vary considerably with the number and kinds of retail establishments visited. Information regarding the nature and variety of alternatives available might possibly be obtained from consumers, but perhaps more reliable information of this kind might be obtained through a survey of the retail establishments to show, for the period to which consumer purchase data relate, the number and kinds of alternatives available. Some of the problems involved in obtaining information regarding the chief factors involved in the selection and purchase of specific items have already been referred to in connection with consumer preference surveys.

Data relating to the number of items purchased and to total expenditures for specific items on the basis of incomes may be used to indicate income elasticity of consumer demand. In using such data for this purpose, some adjustments may be needed for changes in money incomes attributable to changes in purchasing power of the dollar. It is usually assumed in such studies that consumers who move from one income group to another change their purchasing habits to approximate those in the income group into which they move. Perhaps this assumption may be true enough over long periods of time, but it may need some revisions for the shorter periods. Some attempt might be made to obtain data that would show to what extent inertia to change of purchasing habits with changes in incomes of consumers would need to be taken into account in using data on purchases by income groups in measuring income elasticity of consumer demand for specified products.

Retail Sales Survey

Other means of indicating consumer choices as reflected in actual purchases of specified kinds of articles in the market is to contact retailers and obtain from them data to show the number of specific kinds of items sold and the total volume of sales to consumers during specified periods. Such information would indicate consumers' choices on the basis of the alternatives available to them at the time and would give some information with regard to these alternatives. But it would not indicate very definitely the differences in qualities involved nor the factors responsible for the choices made. Some information regarding the reasons for the choices made may be obtained by interviewing customers soon after the purchases are made, but such information is subject to at least some of the limitations already indicated for consumer preference surveys. Such data relating to retail sales would throw little, if any, light on differences in purchases on the basis of consumer incomes, or income elasticity of consumer demand.

Data as to sales of specific products by representative retailers during

a long enough time to include substantial changes in prices would be needed to supply a basis for indicating the price elasticity of consumer demand for these products. In addition to data relating to volume of sales, quality, and prices of the specified and competing products, data relating to changes in demand would also be required. Such data for specific products on a scale large enough for the results to be dependable might be difficult and expensive to obtain.

Both Federal and State agencies have given some consideration to the possibilities of assembling data on prices and on volume of sales under controlled conditions for use in measuring price elasticity of consumer demand for specified agricultural products. This would require special arrangements with representative retailers to offer the specified items at agreed-upon prices which might be changed from one time to another. The measurement of consumer responses to changes in prices under such controlled conditions would make it necessary to take into account the elasticity of shifts in consumer purchases from one establishment to another or from one market to another. In addition, account might need to be taken of the possibility that responses of consumers to advances and reductions in prices, particularly during short periods, might not be normal, especially if consumers were aware that such advances and reductions were made under temporarily controlled conditions.

Summary and Conclusions

Information relating to consumer demands for specific kinds of agricultural products and to the influences of the various factors on these demands is needed for use as a guide in adjusting production to consumer requirements. Problems involved in obtaining this information are complicated and, for best results, evaluation and appropriate modifications of methods that have been used, and perhaps the development of new and more suitable methods, may be required.

Information assembled in connection with consumer preference surveys, designed to learn from consumers, through personal interviews, their preferences with respect to selected products and factors affecting these preferences, needs to be critically appraised from the viewpoint of the significance of the data assembled. Answers to such questions, for example, as "Do you prefer cotton or rayon materials or a mixture for summer street dresses, or does it make any difference to you?", to be comparable, would need to be based on the same assumptions and frame of reference. But apparently no satisfactory means have been devised to indicate the nature and extent of differences in assumptions or frames of references upon the basis of which informants answer such questions. Consequently, there appears to be no way of determining whether the attitudes and reactions

of consumers to cotton and rayon for summer street dresses, for example, are more nearly the same for informants who give similar than for those who give directly opposite answers to such questions.

Similar difficulties may be involved in connection with attempts to obtain information from consumers regarding the chief factors that affect their decision to buy specified articles. Attempts have been made to obtain the desired information in response to such questions, for example, as "What are the most important things you look for in buying a summer street dress?" and "What is the most important factor to you when you buy potatoes in a store—quality, size, or price?" Answers to such questions would of necessity relate to differences in the factors involved, for obviously if there were no differences in style, durability, size, quality, or price, these factors could not influence the choice of the items purchased. Unless the differences in some factors, regardless of how small these differences may be, are considered more important in deciding which item to buy than differences in other factors, regardless of how great these differences may be, correct interpretation of the answers to such questions would require information for each informant to show how much differences in the "most important" factors are considered of equal or of greater importance than specified amounts of differences in the "less important" factors. But apparently no means have been developed for indicating the amounts of such differences in the minds of informants at the time of the interviews, and under such conditions, there is apparently no way of knowing whether the evaluations of the factors considered are more nearly the same for those who give similar than for those who give directly opposite answers to such questions.

Do the results of such surveys, tabulated to show similar answers to such questions in the same columns and different answers in different columns, with the inference that similar answers reflect similar attitudes and reactions, and that different answers reflect different attitudes and reactions, contribute in an important way to an understanding of the nature and characteristics of, and the chief factors affecting, the demand for specific agricultural products? Are research agencies making worth while contributions when they present the results of such tabulations, following a statement of the needs for, and usefulness of, information on the nature and characteristics of, and factors affecting, consumer demand for agricultural products, with the inference that these data supply the needed information or that they contribute in an important way toward meeting these needs?

Feasible plans are needed for obtaining reliable answers to appropriate questions based on assumptions so narrowly defined as to assure that similar answers to specified questions will reflect similar consumer prefer-

ences. Such a plan may require some restrictions in the scope of consumer preference studies, care in the specification of assumptions, and the formulation of appropriate questions. Development of appropriate plans for meeting these requirements offers a challenge and an opportunity to research workers.

Consumer choices, as reflected in purchases under existing conditions, may be indicated by data obtained by interviewing a representative sample of consumers and obtaining from them information as to the number and value of items purchased during a specified period. The usefulness of such data might be improved by supplementary information to show the nature and variety of alternative choices available and the relative importance of factors taken into account in deciding to buy. Data on purchases along with data on income may be used to show income elasticity of consumer demand, but some adjustments may be needed for changes in purchasing power of the dollar and for inertia to change in purchasing habits with changes in incomes.

Data from retailers showing the quantities of the different products sold may be used to indicate consumer choices under existing conditions at a specified time and place. But such data for an extended period, along with information relating to competing products, would be needed for use as a basis for indicating price elasticity of consumer demand. Data on prices and on volume of sales obtained from representative retailers under controlled conditions may be used to indicate price elasticity of consumer demand but it may be necessary to take into account any shifts in consumer purchases from one retailer to another and from one market to another. Some information regarding the reasons for the choices made may be obtained by interviewing customers soon after the purchases are made, but such information is subject to at least some of the limitations already indicated for consumer preference surveys.

PLANNING FOR CITRICULTURE IN ISRAEL

E. L. Levie
Planning Centre, Ministry of Agriculture, Israel

ONE of the tasks of agricultural planning is to determine what branches of agriculture should be developed and what will be the limitations of their development. As citriculture is Israel's most important single branch of agriculture, accounting for about 10 percent of farm income, and is the most important export product, it has been examined in detail.

Production Is Well Established

The origins of citrus growing, mainly in the vicinity of Jaffa, lie as far back as the 16th Century, according to Tolkovsky. The Baedecker guide for Palestine in 1886 mentions large plantings between Jaffa and Ramleh; the same year, about a hundred thousand boxes of Shamouti-Jaffa oranges were exported, mainly to U. K. markets. Directly after the first World War, the total area under citrus was approximately 30,000 dunams (one dunam = ¼ acre = 1/10 ha), from which one to two million boxes per year were exported. The growing of oranges was then a profitable business and was developed by increasing numbers of Jewish settlers, especially after 1933, when many German Jews with some means settled in the country. The Arab farmers also planted many new groves so that in the years between the two wars the planted area increased nearly tenfold from 30,000 to approximately 300,000 dunams of which a little more than 50 percent was in Jewish hands.

In 1939, just before the war, only three-fourths of the area under citrus was in full bearing (225,000 dunams), the bearing acreage of which permitted an export of 15 million boxes, of which 13 million were oranges; 2 million, grapefruit; and several ten thousands were lemons. The lack of shipping space cut exports to 1.5 million boxes in 1939-40, and in the season 1942-43 only a few thousand boxes were exported. The fact that over 80 percent of the crop could not be marketed caused a crisis in the citrus industry which had important results. Although the Mandatory Government at the time gave financial help to the growers, many of them neglected their groves because of lack of funds. Part of the groves were not cultivated nor irrigated and died off, so that in the season 1947-48, when the supply of shipping space had nearly returned to normal only 240,000 dunams of the 300,000 dunams were still bearing fruit and an export of only a little over 7 million boxes was possible.

In 1948, the State of Israel was proclaimed and the Jewish-Arab war broke out. These events brought in their wake large population shifts,

groves were neglected and cut down, and irrigation installations were destroyed. After the smoke of gunpowder had lifted, it was found in 1951 that only 130,000 dunams of bearing citrus groves were still in condition as to justify cultivation in order to expect good crops in the near future.

Not all of the decrease in acreage was caused by the two wars. The increase in population and the parallel development of the towns Tel-Aviv-Jaffa, Petach-Tikvah, Ramat Gan, etc., caused the uprooting of most of the oldest orchards situated in the direct neighborhood of these centers.

In Israel as in many citrus exporting countries, the export market is much more important than the local market, the former absorbing as a rule two-thirds of the total crop while the home market for fresh fruit and the by-product plants will take up the rest. In the years after the second world war until 1954, about two-thirds of the by-products were exported, so that roughly three-fourths of the total crop earned much-needed foreign exchange.

United Kingdom Is Major Market

Before the war the U. K. was, and still is, the most important market—taking more than 60 percent of the orange and grapefruit exports. The remainder is shipped to the continent of Europe, and before 1948 sizable quantities also went to neighboring countries. The shipping season starts about the middle of November when grapefruit from selected groves are shipped. Early in December, the first oranges for the Christmas trade are packed, but the largest shipments are sent after New Year until the end of March. In April, Valencia late oranges are shipped. Before the war, prices—on a comparable f.o.b. basis—obtained on the Continent were only slightly higher than in the U.K. for the eight years average 1930-32 to 1938-39. Since 1948, Continental prices have generally been much better (on the average 25 percent higher) than those obtained in the U.K.

The export trade before the war, was in the hands of a large number of exporters and agents. In 1941, however, the Mandatory Government organized exports and since then the marketing has been in the hands of one single seller, a semi-official body, the Citrus Marketing Board, which supervises not only foreign trade in citrus but also controls supplies to local markets and by-product plants. Selling of citrus outside the C.M.B. is prohibited.

In the years immediately after the war, most fruit imports in Europe were made through single buying agencies of the various governments among which the Ministry of Food in the U.K. was the most outstanding. But after the 1949-50 season, normal trade channels in nearly

all markets were reestablished, although in several countries such as Holland, Norway, Finland, etc., quotas are fixed in trade agreements to which Israel is a party.

It may be mentioned that, in pre-war days, accompanying the increase in exports, the prices obtained for citrus declined so rapidly that the seasons 1937-38 and 1938-39 were, on the average, a loss to the growers. In the hope of stemming this fall in prices per *box*, as far back as 1937-38 some exporters increased the net average weight of the boxes from 34 kg. to 40 kg. In 1938-39 over 70 percent of the export of oranges and grapefruit were shipped in the larger cases and after the war nearly all fruit was shipped in boxes of 40 kg. net content. At the time of writing, however, a tendency to return to the smaller boxes is becoming more and more discernible.

The Planning Question

As has been indicated already, there has been a considerable shrinkage in citrus area, and as the local and export markets seem to hold promises for absorbing increasing quantities of the citrus fruit, the Planning Centre of the Ministry of Agriculture was asked if new plantings of citrus groves up to the pre-war area of ± 300,000 dunams would be a desirable aim of the seven-year Agricultural Development Plan ending in 1960.

The answer to this query is given below in sketchy form. The opinions expressed are those of the author and do not necessarily give the official view of the Planning Centre.

Based upon experience in other countries, notably wine-grapes in France (Ex. Jules Milhan, "Revue Economique 1953," page 704, and oranges in California, Ex. G. E. Sheppard's "Agricultural Price Control," page 246), where a system of free and indiscriminate planting had brought the industry to a permanent stage of overproduction, the optimal area which should be planted under citrus in Israel was defined as follows:

> The optimal area under citrus is the area which will give at average yields maximum returns to the citrus industry as a whole from exports and from local markets. This qualification regarding markets is necessary because in countries such as Israel where there are foreign exchange restrictions which result in an over-valuation of local as against foreign currency, the natural tendency will be to underrate the importance of foreign markets, if the revenue from the latter is expressed in Israel pounds instead of in the foreign currency earned. The priority point of maximal foreign currency revenue from the citrus industry underlie the whole following discussion, the more so because the export market is more than twice as large as the local market.

There are other possible aims in planning the citrus industry. We could try to plan the total area of the lands which would yield under present price conditions at least minimal profits to the citrus farmer. This area would probably be larger than the acreage which would give maximum foreign currency returns. Why the former area should not be accepted as a basis for planning will be discussed at the end of the paper.

Method of Analysis

The problem of maximum returns is solved theoretically as follows:

For every one of the markets the price-quantity relationship will be determined and the maximum value of the product of supply and price per box (adjusted for change in the price level) will be determined. Because we cannot treat every export market individually, four markets are assumed for sake of simplicity:

(a) The U.K. market;
(b) the Continental market;
(c) the local market for fresh fruit;
(d) the market for culls to the by-product plants.

Theoretically, the citrus crop should be divided at least according to oranges, grapefruit and other citrus fruit. However in practice even this simplified pattern cannot be realized in full because of lack of statistical data, especially in regard to (c) and (d) above. Since the maximum returns from these two markets cannot be calculated; their total requirements had to be roughtly estimated to complete the picture. But as exports are to be the more important factor, the over-all picture will still be significant.

Naturally the following analysis would carry much more conviction if a longer time series could have been used, but as planning cannot wait, one has to work with the available data. Since our planning will thus suffer from inexactness, we should therefore, at least, have a safety margin in the total area of suitable land which should be reserved for the extension of citrus groves; this acreage should be larger than the optimal area which will be indicated below. These reserved areas should not be used for building purposes or for growing other than field crops.

The data needed to calculate the correlation coefficients and regression equations are to be found in the Export Statistics of the Mandatory Government of Palestine over one period 1932-1939 inclusive. The Citrus Marketing Board has given statistical material about prices and exports in the post-war period in the years 1951, 1952 and 1953, which are the seasons December 1950-May 1951, December 1951-May 1952, and December 1952-1953.

The prices are quoted in Pound Sterling per 1,000 boxes f.o.b. Haifa Tel-Aviv-Jaffa. In order to eliminate changes in the buying power of the Pound Sterling, all prices are expressed in 1938 Sterling by dividing the returns per 1,000 boxes by the index of wholesale prices (U.K. Board of Trade series for all items) in which 1938 = 100; this is of special importance in comparing the set of post-war prices with the pre-war set.

The basic data, i.e. price index, prices in Sterling per 1,000 boxes, deflated prices, quantities shipped and total returns in (deflated) Sterling for both the U.K. and Continental markets are to be found in Table 1. The results expressed in the form of correlation coefficients and regression equations, and optimum quantities which will give maximum gross and net returns in foreign currency will be found in Table 2.

The regression equations are based on the assumption that the relationship in linear. The fact that the correlation coefficients are fairly high ($r_1 = -0.94$, $r_2 = -0.93$) seems to indicate that this assumption is reasonable.

TABLE 1. QUANTITIES AND PRICES OBTAINED FOR ORANGES SHIPPED TO U.K. AND CONTINENTAL MARKETS

Year	Wholesale price index. All items.[a]	Price per 1000 boxes		Thousand boxes shipped	Total returns, in 1938, £ St.
		In current Sterling	In 1938 Sterling		
		U.K. Markets			
1932	84.4	484	574	2494	1,432,000
1933	84.5	465	548	3037	1,664,000
1934	86.9	469	539	3295	1,776,000
1935	87.7	454	517	4812	2,488,000
1936	93.0	432	465	3828	1,780,000
1937	107.0	360	336	7193	2,417,000
1938	100.0	330	330	6166	2,035,000
1939	101.4	295	291	6956	2,024,000
1951[b]	315	1370	436	2162	943,000
1952[c]	323	1533	475	1746	829,000
1953[d]	320	1230	380	2620	996,000
		Continental Markets			
1932	84.4	480	570	1031	588,000
1933	84.5	466	558	1163	649,000
1934	86.9	482	552	1829	1,010,000
1935	87.7	459	523	2067	1,081,000
1936	93.0	440	474	1887	894,000
1937	107.0	356	333	2933	977,000
1938	100.0	335	335	3600	1,210,000
1939	101.4	287	283	4560	1,290,900
1951[b]	315	1751	556	955	531,000
1952[c]	323	1868	578	1057	611,000
1953[d]	320	1560	490	1810	887,000

[a] Board of Trade Index of Wholesale Prices.
[b] Season Dec. 1950–May 1951.
[c] Season Dec. 1951–May 1952.
[d] Season Dec. 1952–May 1953.

TABLE 2. RELATIONSHIP BETWEEN PRICES AND SUPPLIES OF ISRAEL ORANGES

	U.K. Markets		Continental Markets	
	Period	Period	Period	Period
	1932–39	1951–52–53	1932–39	1951–52–53
Net weight of box-kg.	34	40	34	40
Net weight of box-pounds	75	88	75	88
Price per 1000 boxes	Y_1		Y_2	Y_2
Quantities supplied (per 1000 boxes)	X_1		X_2	X_2
Correlation coefficient	$r_1=-0.944$		$r_2=-0.930$	$r_2=-0.930$
Commentary	Highly significant		Highly significant	
Coefficient of determination	$r_1^2=0.891$		$r_2^2=0.865$	
Regression equation	$Y_1=714$ $-0.058X_1$		$Y_2=684$ $-0.095X_2$	
Optimum quantity to be exported (1000 boxes)[a]	6100	3100		3600
Expected price in £—.[b] Deflated 1938=100	357	333		342
Maximum returns[c] in foreign currency in 1000 Sterling	2.178	1.032		1.304

[a] X optimum = a/2b; [b] Y optimum = a/2; [c] XY maximum = $a^2/4b$.

If net currency returns are to be taken into account (after deductions for packing materials and foreign currency expenditure for fertilizers, tractors, water, etc., have been made):

Net return per 1000 boxes	Y_3			Y_4
Quantities supplied (1000 boxes)	X_3			X_4
Regression equation	$Y_3=549$ $-0.058X_3$			$Y_4=519$ $-0.095X_4$
Optimum quantity to be exported (1000 boxes)	4740	2300[d]		2735
Optimum net return per 1000 boxes £	275	250[d]		260
Maximum return in foreign currency—1000£	1.304	575[d]		712

[d] Estimate from graph.

The correlation coefficients are highly significant for the relationship between prices and supplies in U.K. markets in the pre-war period (8 years) and in the Continental markets for pre-war and post-war periods put together (11 years).

In the latter markets, the demand for Israel oranges did decrease in the post-war period as compared with the pre-war demand. The increase of net weight per box from 34 to 40 kgs., however, seems to have balanced this decrease as it expressed itself in price per box. Therefore, only one regression equation is needed to express the relationship between prices and supplies.

This is not the case in the U.K. markets; there demand seems to have decreased to less than 50 percent of pre-war. The effect is that after the war a given quantity brings about half the (deflated) price compared with what would have been obtained by the same quantity in the pre-war period.

In order to investigate the influence of Spanish supplies on the U.K. prices for Israeli oranges the multiple correlation coefficient was calculated. It appeared, however, that the variance not accounted for by regression was not decreased significantly by including the Spanish supply into the regression equation. We realize, of course, that this rather unexpected result might not have been found in a longer series of observations.

The same negative results were obtained in testing the influence of changes in national income and in population on prices for Israel oranges in the UK markets; these data were not available in Israel for the aggregate of the continental markets.

However it does not seem wholly unreasonable to assume that in the long run the negative influence on Israeli prices of the increased exports resulting from increased plantings in competing countries (especially Algeria) will be offset by increased population and increased national income which are likely to occur in export markets.

Some Expansion Possible

Table 2 gives the optimal exports which will obtain the maximum returns in foreign currency with the equations used for its computation. These exports, as illustrated in Figure 1, were estimated at 6.1 million boxes to the U.K. in case of reestablishment of the pre-war demand for Jaffa oranges. At present reduced demand, the optimum exports are 3.1 million boxes to the U.K. market and 3.6 million boxes to the Continental markets. In order to illustrate these theoretical considerations, a diagram is added (Figure 2) which shows year to year total income from orange exports and the number of boxes exported. The free-hand drawn interpolated line giving the total returns in pre-war years shows a maximum for an export of about 10 million boxes which is about the same as the theoretically computed figures ($6.1 + 3.7 = 9.8$ million boxes).

Although exports of the above-mentioned quantities will give a maximum return of foreign currency, the figures of optimum exports should be reduced considerably if the *net* foreign currency returns are taken into account. It has been estimated that to produce a box of oranges about 10 shillings in foreign currency (7 sh. = $1.00) are needed to purchase packing materials, tractors, current for the pumping of irrigation water, etc., which can (as yet) not be produced in the country.

The maximum net returns will be reached at a much lower level of exports. Israel should then ship to the U.K. market under pre-war conditions of demand 4.7 million cases of 34 kg. net weight or 4 million cases of 40 kg. net. Under post-war conditions of demand, this latter figure should be reduced to 2.3 million boxes; the Continent could take up about 2.75 million boxes of 40 kg. net content.

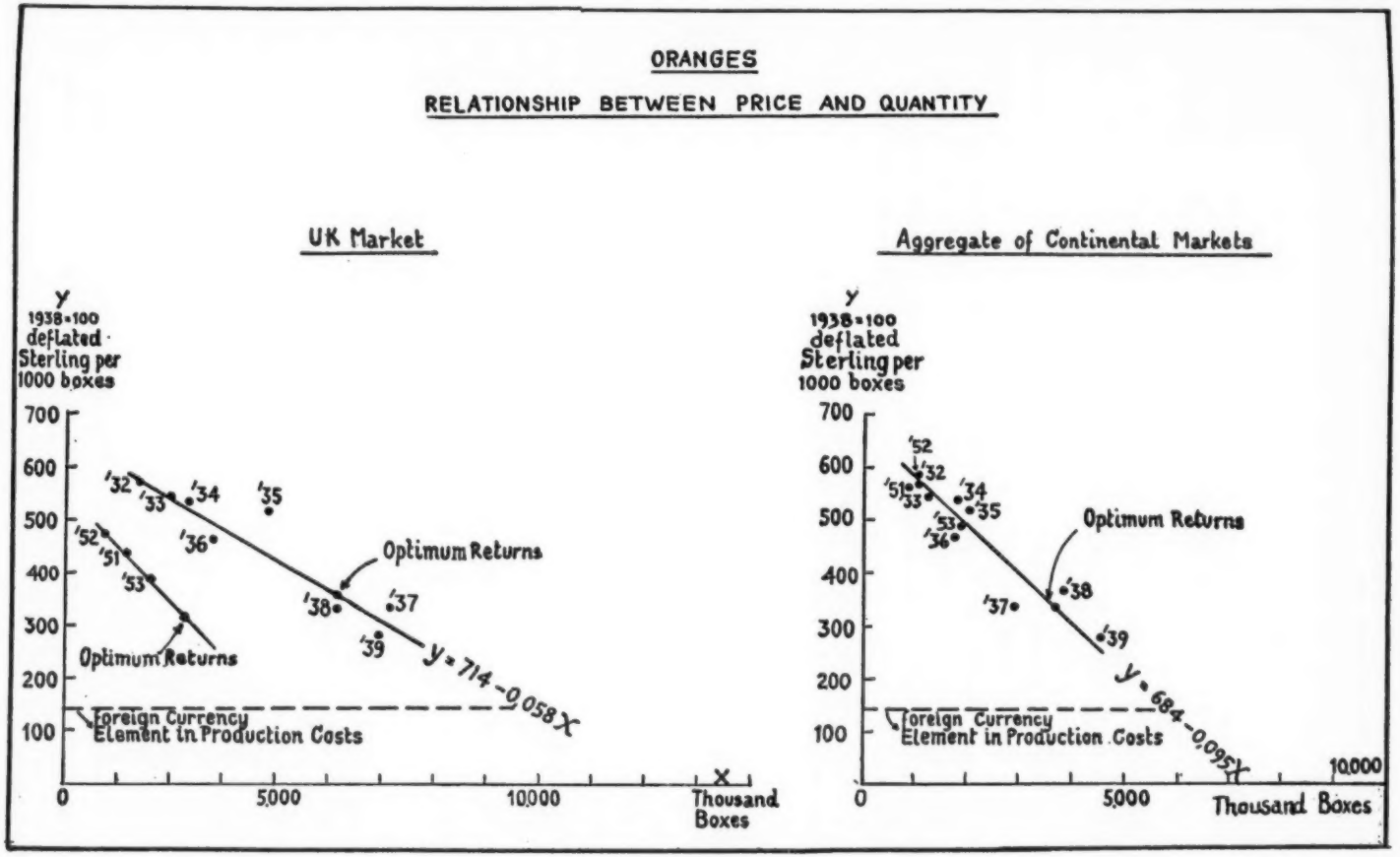

FIGURE 1

Optimum should be read as maximum.

The maximum net returns in foreign currency would be:

	1938—£ =100	1953—£ =320
U.K. markets—pre-war demand	1,300,000	4,175,000
U.K. markets—post-war demand	580,000	1,850,000
Continental markets	710,000	2,275,000

Grapefruit exports which are of much less importance than orange exports may vary between an estimated 1.6 million boxes and 1.8 million to give maximum returns.

Local consumption of citrus fruit is at present about 25 kg. per head. It is believed that when all orange groves are in full bearing total consumption will then be about 50,000 tons assuming a population of 2 million and no important changes in the standard of living. If, by increased industrialization, the standard of living will rise, a consumption of about 40 kg. of citrus fruit per head per annum may be expected. This quantity, which is desirable from a dietary point of view, will equal a total consumption in the local markets of about 80,000 tons.

Statistical information about the needs of the by-product industries is scanty. In 1953 these plants used a total of about 60,000 tons. From a technical point of view, their output and thereby their requirements of fresh fruit could easily be doubled to 125,000 tons per year. In view of the American policy[1] of subsidizing the exports of citrus by-products to Europe, it seems unlikely that Israel could compete and sell the by-products of 125,000 tons of fresh fruits at anywhere near remunerative prices.

Results Summarized

Total joint requirements are summarized as follows:

Quantities of Citrus Fruit needed under:	Present-day Conditions	Optimistic assumptions as to demand increase
	1,000 tons	*1,000 tons*
Orange exports to U.K.	92	160
Orange exports to the Continent	110	110
Grapefruit exports	64	72
Local consumption	50	80
By-product industries	60	125
Total	376	547
Present production	330	330
Expected deficit by 1960	46	217

Obviously, the targets under different assumptions are fairly wide apart. Under present-day conditions, somewhat more than 375,000 tons

[1] Still in force at the time of writing.

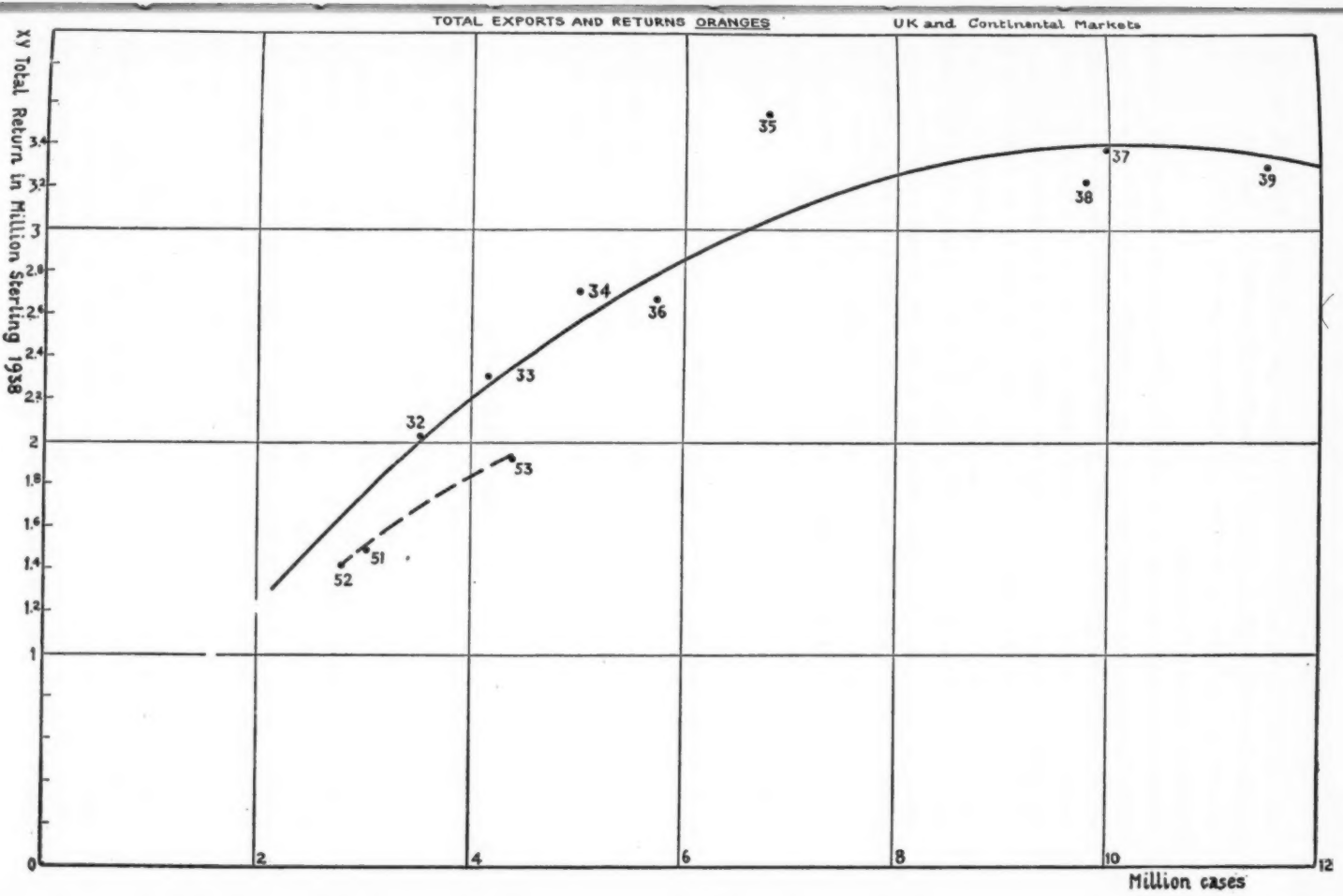
TOTAL EXPORTS AND RETURNS ORANGES
UK and Continental Markets
XY Total Return in Million Sterling 1938
Million cases
0
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
2
4
6
8
10
12
32
33
34
35
36
37
38
39
51
52
53

FIGURE 2

of citrus fruit are needed. Under rather optimistic but justifiable assumptions, about 550,000 tons could be marketed profitably. The last question to ask is what would be the necessary acreage to produce 375,000 to 550,000 tons of citrus fruit.

Present-day production from 115,000-120,000 dunams fluctuates around 330,000 tons. This would leave a gap of 45,000 to 220,000 tons of fruit which could be produced on an additional 13,000 to 66,000 dunams (assuming an average of 3.3 metric tons of fruit per dunam in full bearing groves). However, to keep up the production of the present area, new plantings of about 3,000 dunams per year will have to be carried out in order to replace losses due to normal dying and/or uprooting of present groves caused by the further development of the urban areas. This would mean a need for additional planting of 20,000 dunams until the completion of the Agricultural Development Plan in 1960. Roughly speaking, there is therefore still room for additional planting of between 33,000 (8,100 acres) and over 85,000 dunams (21,000 acres) in the near future, up to 1960. The higher figure could only be recommended if Israel can anticipate:

a. recapturing the pre-war demand in the U.K. market.
b. developing new markets on the Continent of Europe and in the Western Hemisphere.

As soon as an additional 33,000 dunams has been planted, the time will come for reconsideration. Many more observations about the post-war marketing of citrus fruit will then be available which would make the conclusions more reliable.

Divergent Opinion

The foregoing view is not universally accepted in Israel. Some contend that the restriction of citrus planting to the acreage that will maximize foreign currency is the short-term view, in which the balance of payment difficulties are over-accentuated. According to this opinion a long-term view should be taken guided by the physical possibilities of the country to the full extent; restriction of citrus planting would in this context mean a considerable restriction of colonization possibilities in agriculture, because citrus growing is one of the bases of these possibilities. It is not denied that increased production of 300,000 dunams will be difficult to market but a much more sanguine view is taken of the possibilities of the future, especially of the Russian market.

There is a second difference between the two lines of thought. Although there is no exact survey of lands available for citrus growing, it seems likely that by increasing the citrus area up to 300,000 dunams large tracks of sub-marginal lands would have to be used, lands which yield

only 2 tons (50 boxes) per dunam or less and which, under 1952-53 conditions, resulted in a loss to the growers. By increasing exports (doubling or even trebling), prices would fall and many more areas would become unprofitable, entailing both the payment of subsidies to citrus farmers in Israel currency and a loss of foreign currency. The author believes that this subsidy would not be less than the sums to be paid for relief work assuming that citrus planting is restricted to 150,000 to 200,000 dunams and that assuming further no employment in other branches of agriculture or industry for the workers who should otherwise be employed in a citrus industry up to 300,000 dunams. The loss of the foreign currency earning power, however, could not be made good.

In this policy decision in which the aims of colonization, employment, and balance of payment problems have to be reconciled, economic reasoning alone does not decide the issue. These decisions are taken on a higher level than the Planning Centre whose task is only advisory.

NOTES

THE VALUE QUESTION

TWO RECENT articles in *This Journal*[1] have demonstrated the relevance of the value question to discussions of economic policy for agriculture. The questions involves the *goals* that we, individually and collectively, want to attain. We must choose between alternative *programs*. To choose intelligently we must compare the *desirability* of the various possible means of procedure. However, the relative desirability of any program depends on the extent to which it contributes to (or hinders) the *achievement* of such goals as freedom, real income, efficiency, security, and a host of other values of greater or lesser importance.

The value problem involves the determination of our true goals, their relative importance, and the manner and extent to which the various means of procedure available to us relate to the structure of those goals. I feel that this question runs somewhat deeper than the treatment given it in the two articles cited above. If so, a further contribution would seem to be appropriate, especially at this time.

Value Conflicts

Values are realized through *action*. Obviously, if a certain line of action could achieve the fullness of all goals, and if we could recognize this as being the case, then there would be no problem. But whether we like it or not, it is a simple fact that in any particular line of action "you can't have everything."[2] In other words, any particular means of procedure

[1] Erven J. Long, "Freedom and Security as Policy Objectives," August, 1953; and Dale E. Hathaway, "Agricultural Policy and Farmers' Freedom: A Suggested Framework," November, 1953.

[2] Hathaway's approach is based solidly on a recognition of this fact. Long admits the possibility that there might be some situations in which freedom and security would conflict, but this conflict has no place in his analysis. Rather he says (p. 318), that "freedom consists in a set of securities of expectations concerning the behavior of other individuals and groups." Formulated in this way, freedom and security cannot be in conflict because they are defined to be the same thing. Such a formulation contains some insight, but the definition appears to be inadequate. As Long himself suggests, most people's intuitive notion of freedom includes much more than secure expectations. To illustrate—the slave's expectations undoubtedly were more certain before he was freed than afterward. His principal concern was with *what* he could expect. Long says (p. 319), that "the slave became a free man . . . in consequence of a set of restraints imposed upon others." True, but not the whole truth. The nub of the matter was that *a set of retraints on the slave were relaxed*. This could have been voluntary on the part of the owners. In some cases it was. In any case the restraint was imposed on slave owners to achieve the higher value of relaxing a more severe set of restraints on the slaves. All in all, Hathaway's definition (p. 497), "that an individual is free when he is able to do an act or not to do an act" seems clearly superior. And this avoids removing, by definition, the real problem of value conflicts.

will involve some value conflicts. The question then becomes: which course of action will best serve our over-all value structure?

Choice is made and action is taken by both individuals and groups. Consequently value-conflict has both a personal and a social dimension. For an individual the question is reasonably straightforward. He makes the choice between his available alternatives with the knowledge that the consequences of his action will impinge on him. Some of his goals will be attained relatively fully, some less fully, and some will be sacrificed. But in any case *he* makes the choice of action in relation to his own value structure.

Group action is more troublesome from a value standpoint. Any particular program undertaken by a social group also will involve value-conflict for the individual, but in this case the choice of action is not solely his. In fact he may have only a minor voice in the decision. Consequently a social action can be very dissonant with an individual's value structure. Thus social action involves conflict not only *within* the value structures of individuals but also *between* these structures.

An individual can discover his own value structure through introspection and the application of reason to his experience. On the other hand a social group cannot introspect. The minds and feelings in the group are those of *individuals*. How then can a value structure be derived for the group if, as is likely, the structures of the group's members are diverse and even contradictory? A value structure must be derived for the group if its programs of action are to be chosen intelligently.

Values and Values

There are all kinds of values. Some of them are completely subjective: purely a matter of personal taste. One man likes lobster better than steak for the good and sufficient reason that he likes lobster better than steak. In matters like this, one man's taste is as good as the next man's, and that is practically all that can be said about it. *De gustibus non disputandum.*

However, there is a limited supply of economic goods like lobster and steak. Somehow this supply must be allotted among consumers whose tastes differ. The consumers express their preferences by apportioning different shares of their incomes for the purchase of the various types of goods. Thus, in effect, they bid against one another for the available supplies. In the process, prices are established—relative prices being expressions of economic value for the system as a whole. This vast oversimplification of a complex process is presented only for the purpose of suggesting that where subjective values are involved exclusively, some kind of voting or bidding mechanism may provide a very reasonable resolution of value conflicts.[3]

[3] To anticipate objections, I realize full well that our market mechanism is far

Not all values are purely subjective. For example, all intermediate values (i.e., those which stand in the relation of *means* to ends) have an objective dimension. Whether or not a certain means will contribute to the realization of a certain end is simply a matter of objective fact, insofar as it can be determined. Obviously, this is where the scientist (the "expert") fits into the picture. He is best qualified to ascertain the fact in question; that is his specialty. Of course, any one line of action will have a multitude of consequences, even though one particular consequence is viewed as the principal goal to be reached. When a particular line of action is appraised, all ascertainable consequences must be evaluated in their status in re ends.[4]

The scientist does not appear to be especially well qualified to make this determination. If an individual is choosing between alternative actions, only he can evaluate the consequences that affect him. Any action he takes will set in motion a chain of consequences that undoubtedly will involve some value conflicts. Only he knows—at least he certainly knows best—the priority of his own values. He will choose the course that serves his greater values (as he sees them at the time) and he will sacrifice his lesser ones. Or, as Hathaway points out, he will (where possible) compromise values by shading them at the margin.[5]

Social Value

Human value inheres exclusively in *individual persons*. There is no other place that this value *could* reside, because human beings *are* individual persons.[6] However, man's needs cannot be fully satisfied nor can

from perfect, and also that our unequal distribution of income allows some individuals to cast many more "dollar votes" for economic goods than other individuals can. But this says only that our present bidding or voting mechanism could stand improvement.

[4] Long makes this point specifically on p. 322.

[5] Hathaway's discussion of absolute values (p. 499n) appears to me to be inadequate. I doubt if anyone seriously considers freedom and real income to be mutually exclusive absolutes. I expect that most of us who consider ourselves to be absolutists would hold that there is really only *One Absolute Value*. All other values, being related to *This One*, are ordered in their relativity. According to this view, man has value because of his unique relationship to the *Supreme Value*. Since man is a creature of body and spirit, both of these essential elements have value (although the spirit is the higher faculty of the two). The body, being good, has wants and desires which are good (including a possible desire for lobster). The *fulfillment* of these desires is good insofar as the *act* or *situation* involved in the fulfillment does not *directly contradict* or *negate* higher values, including the spiritual. Over vast areas of value-conflict there is no direct contradiction. In this area it is a matter of balance, proportion, and compromise somewhat like Hathaway's description. However, there is an area of value-conflict involving complete contradiction. For example, there are circumstances in which a man's desire for something can be fulfilled only through the act of taking another man's life. Here no compromise is possible.

[6] Long says (p. 318) that freedom does not inhere in an individual. Here Long ignores the fundamental distinction between values and the acts and circumstances

his powers be fully exercised as an individual. For this wider satisfaction and development, man must associate with (and cooperate with) groups of his fellow men.[7] But these larger groups have value only to the extent to which they contribute to the realization of values by *individual persons*. In other words, these larger groups serve as means to individual ends.

In any case, many social groups do expand the realized values of individuals, and social groups we have in abundance. But like individuals, social groups realize goals only through action. Such action will have a chain of consequences. Again these consequences can be traced most effectively by the "experts," so there is no problem on that score. But these consequences will impinge differently upon the different priorities of values possessed by different individuals. In view of this value conflict *between* individuals, how does the group evaluate the consequences of its action? This, in brief, is the problem of social value (group choice).

Hathaway attempts to solve the problem by casting his schema in terms of the values of the *majority* of the group.[8] This is the way that most value conflicts between individuals are resolved in a democracy. *But not all!* In our country, for example, the minority has some rights even against the will of the majority. The first ten amendments to our constitution were appended to secure those rights. Our country was founded upon the assertion that "all men are endowed by their Creator with certain inalienable rights." Values which are *rights* are *not* purely subjective. With respect to inalienable rights the voting mechanism is not a proper instrument for resolving value-conflict.

I think all of us would agree that it would have been wrong for the Nazis to have killed all the Jews in Germany even if all the Germans, *including the Jews*, would have voted for it. This illustration is not as fantastic as might appear at first glance. With modern techniques of propaganda, amazing things can be done with people's votes, and with recent

through which values are realized. For example, how could subjective values possibly reside anywhere else but in subjects (persons)? Yet a taste for lobster certainly cannot be realized without obtaining the lobster. Roughly the same thing can be said for freedom, except that all normal men desire it, and that desire comes from the nature of man (according to the view of our founding fathers) whereas the desire for lobster is induced and acquired.

[7] Long, in effect, posits the proposition that every time two men cooperate one man loses to the other. He says (p. 320), "Two men in an economic Garden of Eden would each be trying to manipulate the other for his own purposes." Admittedly, pragmatically inclined persons are often tempted to do this. Some try to resist the temptation on moral grounds. Others must be policed to some extent. In any case, there is a tremendous area of human cooperation in which most or all individuals gain. I suspect that in the Garden of Eden the mutual manipulation of Adam and Eve was quite satisfactory to both. Hobbes notwithstanding.

[8] C.f. p. 502 ". . . a higher satisfaction curve of the majority of the farm population," and also p. 502 n. ". . . the congressman does so in line with his estimation of the satisfaction surfaces of a majority of his constituents."

techniques of brainwashing, such as those demonstrated by the Communists, people's opinions can be reoriented rather sharply. With modern refinements in "persuasion," it would seem that now, more than ever, we as a nation should guard jealously the rights of the minority against tyranny of the majority. Hence, especially in the area of inalienable rights, Hathaway's schema does not seem to be an adequate solution to the problem of social value.

A Suggested Approach

How can universal propositions about human value be made? It seems obvious that the only way is to begin with universal propositions about human beings. I think that all us would agree that all normal men are rational.[9] So here we have one universal proposition about human beings.

Man's ability to reason enables him to make rational choices between alternative acts that impinge differently on his scale of values. This ability to choose rationally is an essential part of man, and his development *as man* is associated with his exercise of that ability. *Since man inherently possesses the ability to choose, the dimension of his realized freedom depends on the number of available alternatives from which he can choose.* Consequently, the wider the range of alternatives available to him, the greater is his opportunity to develop *as man.*

As stated earlier, man's needs cannot be fully satisfied nor can his powers be fully exercised as an individual. Through association with his fellow men his alternatives are widened immeasurably.[10] If that association is voluntary it has immediate value to the individual because the very fact of voluntary cooperation involves the exercise of responsible choice. But even involuntary associations (the state, for example) can enlarge tremendously the individual's *net* area of choice. I say "net" because any involuntary membership in a group restricts at least one area of a man's available alternatives. However, it may open up many other alternatives for him. Or it may even give him new opportunities to create alternatives for himself. In any case, the individual is interested in his *net* area of choice. The state should make this area as large as possible. The state exists, *not to make decisions for individuals,* but rather to provide the conditions in which individuals themselves can make the largest *number* of decisions, and the most *responsible* decisions.[11]

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[9] The term "rational" is used as meaning the ability to learn to reason with abstract concepts: simple arithmetic, for example.

[10] Long makes this point explicitly on p. 319 of his article.

[11] In this connection I do not see how anyone could construe a program of acreage allotments as a restriction of the farmer's freedom. With acreage allotments, participation in the program is entirely voluntary. The program merely provides an additional alternative from which the farmer may choose.

Previously it was stated that man's ability to reason enables him to make rational choices between alternative acts that impinge differently on his scale of values. However, if a man is forced to choose between alternative acts whose consequences are completely uncertain, then he has no way of knowing how his values will be served. In this event, his rational faculty is of no avail; rather than think about it he might just as well flip a coin. It would seem that the exercise of choice in such situations would not especially contribute to man's development as man. On the other hand, *the more certain the consequences of a man's act, the more use is his reasoning faculty in choosing between acts on the basis of his scale of values.* Hence, other things being equal, the more certain a man's expectations, the greater his opportunity to develop as man. And social groups can accomplish a great deal in the way of making a man's expectations more certain.[12] In this way the man is enabled to make more responsible decisions.

Thus social action can provide the conditions in which individuals can make the largest number of decisions, and the most responsible decisions, in two ways: (1) by enlarging the number of alternatives from which they can choose, and (2) by making more certain the expectations on which they base their choice. The important thing is that the choices be made *by* individuals rather than *for* individuals. "*Society exists that man may be more fully man.*"

L. JOHN KUTISH*

Federal Reserve Bank, Chicago

[12] Contrary to Long's position (p. 318), this does not always involve placing involuntary restraints on other men. People can cooperate voluntarily in order to reduce or spread risk. Insurance is an example.

* The viewpoint elaborated in this article represents the author's personal convictions, and in no way constitutes a statement of policy by the Federal Reserve System. Many of the ideas presented herein were derived from F. J. Sheed's book, *Society and Sanity*, Sheed and Ward, New York, 1953.

A REPLY* TO KUTISH'S THE VALUE QUESTION

MY GOOD friend, John Kutish, has raised many points of issue with my recent article on "Freedom and Security as Policy Objectives."[1] Some of the differences derive from substantial departures in our basic viewpoints and others from misinterpretation of certain aspects of my argument. The purpose of this reply to his rejoinder on my article is not so much to do battle as to clarify some of the sources of disagreement.

* Thanks to John M. Brewster for his helpful suggestions.

[1] *This Journal*, August 1953.

1. His first criticism has to do with my inadequate definition of freedom (his footnote 2.) Clearly my statement which he quotes *is* an incomplete definition. It is my assumption that any attempted "definition" of freedom in one sentence can be only tautological and must ignore the complexity of the concept. In fact my entire article was but an attempt at a sketchy outline of a meaningful definition of freedom through analysis of the processes by which it comes into being and is sustained. I reject his argument that I "remove by definition the problem of value conflicts" (His footnote 2). In fact, I see no significant difference between my argument on this point and Hathaway's definition, which Kutish accepts. Hathaway says "an individual is free when he is able to do an act or not do an act. Notice that this concept of freedom implies both his *ability to choose* to do an act or not do the act, and the actual *ability to carry out that act* if he should choose to do it or not do it." (Italics his). I make the same point when I say that: "It (freedom) becomes meaningful only in specific terms which must include *a structure of opportunities* which make the realization of the freedom possible." (Italics in original). Kutish appears, in footnote 2, to be refuting my argument that freedom requires security of expectations by arguing that one can have security without freedom, with which I agree. But this has nothing to do with the quite different point that an individual cannot have freedom in the absence of security of expectations regarding the conduct of others. Later, in footnote 6, he criticises my statement that "freedom does not inhere in an individual," yet he accepts Hathaway's definition of freedom as, in essence, the power to act. How can he accept this definition of freedom and at the same time argue that it inheres in the individual (rather than in his relation to social processes) when it is so clear that, in Hathaway's terms, "the actual ability to carry out an act" is always socially conditioned?
2. Kutish criticises me for ignoring "the fundamental distinction between values and the acts and circumstances through which values are realized" (footnote 6). This criticism appears to root in a fundamental difference in philosophic viewpoint, judging from his footnote 5. The question at issue here is whether or not the set of values held at any moment of time by an individual is independent of the activities that individual has engaged in in the pursuit of these or previously held values. More simply, it is the question of whether individual values are culturally determined. Although this issue has been a matter of centuries-old debate, it would seem to me to be a matter of evidence. If man's values are importantly affected by his

cultural and economic milieu (and these in turn by his society's historical development) then clearly the process of value creation and value achievement are interrelated in some sort of continuing process. Kutish intimates that some values (desire for lobsters) are so created but that others (desire for freedom) are deposited in man by some external process (footnote 6). At another point however, in discussing the power of modern propaganda, he indicates that it is not unrealistic to believe that people's values are so maleable to cultural processes and persuasions that they might even vote to have themselves exterminated. I agree with this latter point, and can't, therefore, accept his former argument.

3. Kutish criticises me for "in effect, posit (ing) the proposition that every time two men cooperate one man loses to the other." Here he misses the point, though he catches it again in his statement that "man's needs cannot be fully satisfied nor his powers be fully exercised as an individual." The point is that joint or associated action is needed to achieve men's purposes and this involves an instrumental relationship between men, so that social organization of these relationships is prerequisite to the realization of any of the purposes of the individuals. Of course, in cross section, many relationships between men involve no evidence of conflict, precisely because those relationships operate within an accepted, well ordered framework of social and legal restraints defining the appropriate roles, rights and responsibilities of the participants. Within this context of an ordered society, people certainly can and do, as he indicates in footnote 12, cooperate voluntarily to their mutual betterment. I suspect that Kutish's suspicion that Adam and Eve's mutual manipulation was satisfactory to both is correct; but I should point out with equal facetiousness that Biblical authority indicates that by the second generation conflict had intensified to the point of murder.
4. I agree entirely with Kutish's comment (footnote 11) that a program of acreage controls need not result in a restriction of the farmer's total freedom. If acreage controls result in higher incomes, this higher income brings many "freedoms" with it. (Economists recognize this relationship between income and freedom by referring to the "budget restraint" imposed upon a consumer by his income.) Thus a farmer choosing between release from acreage controls and higher incomes is not choosing between freedom and income, but between freedom to choose his own land uses, and freedom to do the things which higher incomes make possible. Similarly, the choice of "security" over "freedom", actually is a choice of one freedom over another—the freedom to keep up on mortgage pay-

ments, freedom from fear of total income loss in the event of job loss or ill health, etc. In short, not until one gets specific about the choice involved can one appraise intelligently "freedom versus" anything; because such a choice is usually a choice among different freedoms. This being the case, discussion of such decisions should deal with the substantive issues themselves rather than being cast in terms of the slogans and generalizations which attach themselves to such labels as "security" and "freedom".[2] It was my hope that my earlier article might contribute to this end.

ERVEN J. LONG

University of Tennessee

[2] See "Price Support Semantics," by Roger W. Gray, *This Journal*, November 1953, pp. 611-13.

VARIATIONS IN CROP FORECASTS FOR COTTON

FORECASTS of cotton production have been made by the Crop Reporting Board of the Department of Agriculture since 1915. Each year the first forecast of the size of the crop is made as of August 1 and a forecast is made monthly thereafter with the last estimate being made as of December 1.

The first estimate of acreage in cultivation on July 1 is issued early in July. Subsequent revisions of this estimate are made in December and May. Occasionally, further revisions have been made at later times following census enumerations. As the July 1 acreage partially determines the size of the crop, the accuracy of the first acreage estimate affects the accuracy of the crop forecasts.

The forecasts are based on the assumption that the various influences which affect the growth and harvesting of the crop after the date of the forecast will be average or normal. If these influences are not average, the actual crop will vary from the forecast. The main purpose of this note is to appraise the accuracy of early season forecasts of cotton production from 1915 to 1952 as indications of final ginnings. Primary attention is given to the dispersion of differences between forecasted and actual production, but the data are also examined for evidence of systematic errors or "biases" in estimating crops of different sizes.[1]

Acreage Estimates

If the July estimate of acreage in cultivation on July 1 showed a significant difference from the revision of this estimate issued in the follow-

[1] The data on which this note is based are available upon inquiry from the author.

ing May, the August and subsequent production forecasts might show significant variation from actual ginnings for this reason alone. The estimate issued in July differed on the average by 771,000 acres from the estimate issued in May, sign disregarded, from 1915 through 1952. This represented 2 percent of the average May estimate. When signs were considered, the error of the mean difference was larger than the mean difference itself, as shown below:

Mean (1,000 acres)	− 111.05
s_M (1,000 acres)	196.70
t_M	0.56

Therefore, the average difference between the estimates issued in July and May was well within the range of chance fluctuations.

A benchmark revision of acreage in cultivation on July 1 is made for a number of preceding years after each Census of Agriculture is published. In May 1933 all acreage figures from 1915 through 1932 were revised downward. This long-time revision affects the difference between the first and the final acreage estimates for all years in the same direction and for concurrent years by about the same magnitude. Therefore, such differences are not analyzed statistically in this note. However, the estimates were split into two groups in an effort to see whether the early years showed significant bias between the July and May estimates while the later years did not. Although the 1915-33 period showed a larger average difference than the 1934-52 period, the average difference did not differ significantly from zero in either period. Thus, the average variation between the estimates issued in July and May were within the range of chance fluctuations in both periods. These measures are:

	1915-33	1934-52
Mean (1,000 acres)	− 505.3	283.2
s_M (1,000 acres)	332.8	176.1
t_M	1.5	1.6

Early Season Crop Forecasts and Final Ginnings

The August 1 forecasts differed on the average by about 961,000 bales, sign disregarded, from actual ginnings. In 14 of the 38 years, this forecast differed by less than 500,000 bales from actual production, and in 20 years it differed by less than 1 million bales from actual production. On a percentage basis, the August forecast was within 5 percent of actual ginnings in 16 years and within 10 percent in 27 years.

From time to time during the last 30 years, comments have been made on an apparent tendency of the Crop Reporting Board to underestimate large cotton crops and to overestimate small crops. In an effort to check this observation, the 38 crops (1915 through 1952) were split into two

groups, those larger than average and those smaller than average. Such a division could be made by using (1) the average of actual ginnings or (2) the average of the August forecasts as the dividing line. Both methods were considered.

When the average of the actual ginnings was used as the dividing line, an apparent "bias" was found. For large crops, in about 2 in 3 years the August forecast was smaller than the actual ginning and the forecasts in subsequent months tended to increase in size. For small crops, in about 3 in 4 years the August forecast was larger than actual ginnings and successive monthly forecasts tended to decrease.

These results arose, to a large extent, from the fact that several large crops have been helped by better-than-average growing conditions and several small crops have been hurt by worse-than-average growing conditions after August 1. The average reduction from a full yield because of six stated causes[2] for all 38 years was 35.1 percent. The average for the large crops was 33.2 percent and the average for the small crops was 36.7 percent. The modification of crop prospects because of these developments is quite consistent with the assumption of average growing conditions which underlies the forecasts.[3]

In order to test whether the variations in the forecasts were random, a regression analysis of actual ginnings on the August forecasts was made, as follows:

$$X_1 = \underset{(1.34)}{-1.184} + \underset{(0.10)}{1.101}X_2$$

where X_1 = final ginnings, X_2 = August crop forecast, $r^2 = 0.77$
Figures in parentheses are standard errors of the regression constants.

The slope of the regression line is not significantly different from 1 and the constant term "a" is not significantly different from zero. This indicates that the basic variations in the August forecasts were essentially random.

To test the effect of non-average growing conditions on the size of the forecasts, regressions between the actual crop, the forecasts, and the condition variable mentioned above were run. The regression in which the August forecast was used indicated that if the "condition" variable could have been forecasted, the August forecast of the crop would have been more accurate,[4] as shown below:

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[2] The six stated causes are: Deficient moisture, excessive moisture, other climatic, plant diseases, boll weevil, and other insects.

[3] As noted earlier, "normal" or average harvesting conditions after the date of the forecast are also assumed. However, there are no data on which to base an analysis of the effects of the departure of harvesting conditions from normal.

[4] The "condition" variable was estimated after the fact and no forecasts of "condition" were available at the time the August forecasts were made.

$$X_1 = 2.4243 + 1.0139X_2 - 0.0716X_3$$
$$\qquad\qquad\quad (0.099) \qquad (0.028)$$

where X_1 = final ginnings, X_2 = August forecasts, and X_3 = condition $R^2_{1.23} = 0.8068$, $r^2_{12.3} = 0.7489$, $r^2_{13.2} = 0.1553$, $s_{1.23} = 1.1537$ (million bales), $s_1 = 2.5532$ (million bales)
Figures in parentheses are standard errors of the regression coefficients.

Thus the differences between the August forecasts and the actual crop apparently were due in part to the departure of growing conditions from "normal."

When the "condition" variable was used in similar regressions with the forecasts for September, October, November, and December, the regression coefficient for condition was not significant. The condition variable used in the analyses relates for the most part to growing conditions. Since most the cotton crop has finished its growth by September 1, it is logical that "condition" would not significantly affect the forecasts subsequent to August.[5] A quantitative measure of harvesting conditions is not available.

If non-average growing and harvesting conditions were partially responsible for the apparent bias, it would be less noticeable when the August forecasts were used to divide the crops into large and small groups and, in fact, the apparent bias does disappear. For both large and small crops, actual ginnings were about as likely to turn out above the August forecast as below it, regardless of whether the August forecast was for a large crop or a small one. If the differences are expressed as percentages of actual ginnings, the level of accuracy is nearly the same for both groups.

The standard errors of the mean differences are larger than the mean differences themselves regardless of whether we are discussing, large small, or all crops. (See Table 1.) *The average difference for both large and small crops is well within the range of chance fluctuations.* Similarly, the average differences for September, October, November, and December forecasts in relation to their standard errors do not suggest a significant bias.

Successive Forecasts

Figure 1 shows that the differences between the forecasts and the

[5] The coefficients of determination using the "condition" variable and without the "condition" variable are shown below:

X_3	r^2_{13}	$R^2_{1.23}$
September	0.8205	0.8225
October	0.9061	0.9062
November	0.9719	0.9752
December	0.9879	0.9907

X_1 = final ginnings, X_2 = forecast for indicated month, and X_3 = condition.

actual crop were progressively smaller as the season progressed. This was to be expected. More is known about the crop as larger proportions are harvested. For example, ginners start submitting their estimates of the crop for the October 1 forecast. The chart shows that the average difference between the October forecast and the actual crop is considerably smaller than for the August and September forecasts. However, the November and December forecasts are more accurate than the October forecast, primarily because the ginners, as well as other respondents, are able to make more accurate estimates at the later dates.

The December forecast was usually a fairly good forecast of actual ginnings. Half of the December estimates were larger than actual ginnings and half were smaller. The average difference was 191,000 bales, sign disregarded. The December forecast was within this range of actual ginnings in 26 of 38 years.

TABLE 1. DIFFERENCE BETWEEN INDICATED FORECAST AND ACTUAL GINNINGS WITH DIVISION INTO SIZE-OF-CROP GROUPS BASED ON AUGUST FORECASTS (FORECAST MINUS GINNINGS)

(Crops with August forecast smaller than 12,590 thousand bales[a])

Item	August	September	October	November	December
	1,000 bales	*1,000 bales*	*1,000 bales*	*1,000 bales*	*1,000 bales*
Average difference[b]	758.30	617.57	561.00	255.76	181.39
Mean	+ 41.52	−133.57	−161.87	− 31.53	− 36.96
s_m	194.88	156.90	149.70	95.90	48.15
s_x	934.59	752.45	717.95	395.42	230.92
	Crops with August forecast larger than 12,590 thousand bales[a]				
Average difference[b]	1,271.80	1,168.53	739.27	375.54	206.60
Mean	−282.60	−572.93	−228.60	− 41.87	− 16.33
s_m	416.80	371.20	231.96	126.33	70.93
s_x	1,614.25	1,437.66	898.38	455.48	274.70
	All crops				
Average difference[b]	961.00	835.05	631.37	307.67	191.34
Mean	− 86.42	−307.00	−188.21	− 38.80	− 28.82
s_m	200.73	175.17	127.01	75.76	39.86
s_x	1,237.38	1,079.85	782.92	414.95	245.69

[a] Average of August forecasts 1915–52.
[b] Sign disregarded.

The August Forecast As An Indicator of Year-to-Year Changes

If the August forecasts were reasonably accurate indicators of the actual crop, they would forecast changes in the size of the crops from year to year fairly accurately. A regression analysis was made of the relation between the change from the preceding December estimate to

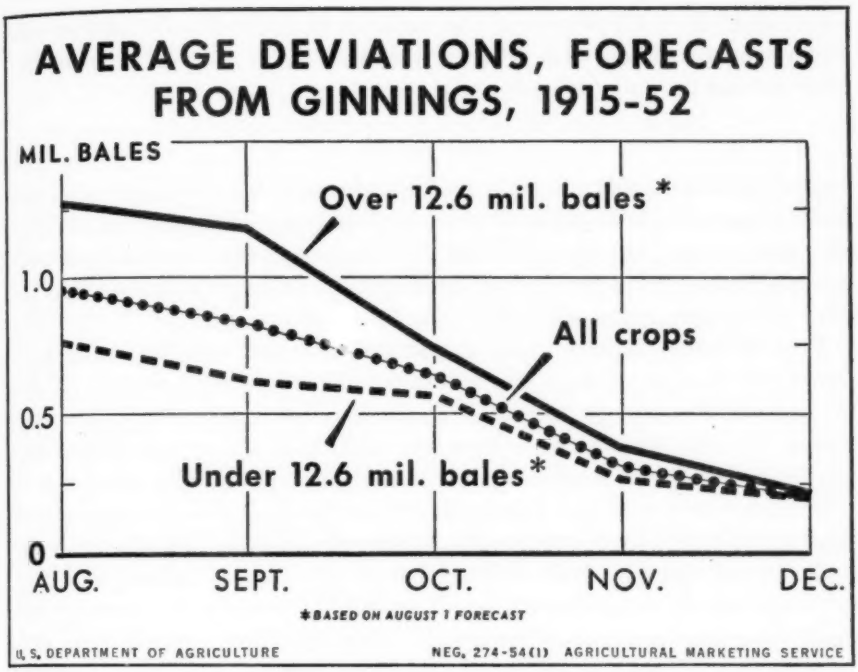

FIGURE 1

the current December estimate (the dependent variable) and the change from the preceding December estimate to the current August forecast (the independent variable), as shown below.

X_1 = December (t) − December (t-1)
X_2 = August (t) − December (t-1)

$X_1 = 0.079 + 0.927X_2$ $\quad s_1 = 2.97$
$r^2 = 0.84$ $\quad s_{12} = 1.20$

This regression showed that about 84 percent of the variance of successive December estimates was associated with differences between the December forecast and the succeeding August forecast. As explained above, the December estimate was usually very close to actual ginnings, approximately the same relationship exists if actual ginnings are substituted for the December estimates in this regression equation.

The August forecast for *cotton* was a better indicator of the changes in the December estimates than the July forecasts for corn were of December estimates of corn production. In the case of corn, Clough[6]

[6] Malcolm Clough, U. S. Bureau of Agr. Econ.: *Changes in Corn Acreage and Production After the Early Indications:* "Agricultural Economics Research," 3(4):140-146. October 1951.

found that about 62 percent of the variance of successive December estimates was associated with differences between the preceding December estimate and the July forecast.

Conclusions

Examination of the record from 1915 through 1952 indicates that the early season forecasts differed from final ginnings in large part because of variations in growing conditions from average. This is consistent with the assumption of normal growing and harvesting conditions after the date of the forecast, under which the forecasts are made.

The difference between the August forecasts and the December estimates for the preceding year accounted for about 84 percent, on the average, of the change from one December estimate to the succeeding December estimate. On the whole, the early season forecasts of the cotton crop have been reasonably accurate indicators of final ginnings.

Further analysis shows no significant evidence of bias in the current production forecasts relative to final ginnings. Analysis indicates that the early season forecasts have fallen fairly evenly above and below actual ginnings. When the August forecast is used as a basis for dividing the years into large and small groups, both groups show a fairly even distribution around actual ginnings.

FRANK LOWENSTEIN

United States Department of Agriculture
Agricultural Marketing Service

EFFECT OF FEED PRICE STABILIZATION PROGRAMS ON LIVESTOCK

A PERSISTENT issue in farm price policy is whether programs to stabilize supplies and prices of feed grains are beneficial or harmful to producers of livestock. At present, prices of all feed grains are accorded price support. Prices of corn are supported at 90 percent of parity under mandatory provisions of law, and prices of other feed grains are supported at 85 percent of parity under discretionary authority allowed the Secretary of Agriculture. Among livestock products only dairy products and wool are receiving price support.

Support of feed-grain prices and nonsupport of prices of most livestock products has sometimes been objected to on a principle of "unfairness" or on grounds of interference in feed-livestock price mechanisms. On other occasions the objections are less abstract, as at times of falling livestock prices the unchanged prices for feed are cited as injurious to

the livestock industry. Cattle producers and feeders frequently took this stand during the period of declining cattle prices in 1953. They asserted, with justification, that reduced prices received for slaughter cattle would not have resulted in such serious financial losses if the feed fed had not cost so much.

As feed and livestock are joined in a single interdependent economy, these questions have both theoretical and practical relevance. Present knowledge of feed-livestock interrelationships can be drawn on to indicate the general effect on livestock of programs to stabilize prices of feed. Feed price programs are considered for this review to be of the type now in force whereby grain moves into storage when market prices are appreciably below an announced support price and moves out of storage when market prices reach a specified point above the support price. Alternative specifications such as introducing a flexible support schedule would modify the conclusions but would not contradict them.[1]

As a general conclusion, elaborated later, it appears that programs to give stability to price and supply of feed grains are of positive value to producers of meat animals and other livestock. Producers find more advantage on the whole in having an adequate supply of feed available at a relatively stable price than in being subject to constant varying supplies and even more variable prices of feed. These are primarily short-run benefits, revealed in less abrupt year-to-year fluctuations.

The benefits are not unmixed. Feed programs do not spare livestock men occasional painful adjustments in their livestock business. Price relationships between feed and livestock have long acted as a governor of the scale of livestock production. This regulatory function is easily—in fact, appreciatively—accepted when the relations are favorable to livestock producers. No dairyman objects to a butterfat-feed ratio that is high, nor does any hog producer resent a high hog-corn ratio. Both acquiesce less eagerly in a ratio on the low side, which impels a contraction in livestock output. Insofar as variations in these ratios remain, the livestock industry will continue its successive ups and downs. A test of any programs affecting livestock is how well they smooth out variations in feed-livestock price ratios and temper adjustments in livestock production.

Specifically, feed price programs reduce one of three sources of variations in feed-livestock price ratios but have less effect on the other two. That is, they very materially smooth out feed-livestock variations caused by annual fluctuations in production of feed; they leave untouched those caused by built-in cyclicality of the livestock industry; and they intensify

[1] Under provisions of the Agricultural Act of 1954 flexible supports are authorized for the corn crop of 1955 and later.

but shorten those caused by changes in demand. The combined result is a significant though moderate advantage to the livestock industry.

Effects of feed price programs differ by kinds of livestock and areas of production. Most of all they differ according to trends in consumer demand. Most of the misunderstanding of the economic implication of feed price programs has to do with their operation under various conditions of demand. Because trends in demand are so important, separate consideration is given to conditions of stable and those of varying demand.

Stable Demand

When consumer demand for livestock products is stable—that is, when the number of persons employed and their incomes remain about the same from month to month or year to year—a program of price supports and storage for feed grains is unquestionably a stabilizing factor to the livestock industry. This is especially true after the industry gets itself adjusted to the level of demand and of feed prices. For then, with producers receiving comparatively steady prices for the products they sell and aided by less variable supplies and prices of feed than would otherwise exist, the scale of livestock production can be smoothed out to a more nearly uniform level. To be sure, complete stability is not accomplished, but the fluctuations that remain are less severe than those before.

The degree of stability would vary according to whether the livestock is grain- or forage-consuming, and whether it is produced in feed-surplus or in feed-deficit areas.[2] Present price programs for feed concern only the feed grains. They do not include hay or other forage. Livestock such as hogs and poultry, for which 85 and 71 percent, respectively, of the feed is feed grains (most of the rest is byproduct feeds), are most directly affected by price and storage programs for these grains. Beef cattle on feed receive 67 percent of their feed from grains and they also are immediately influenced by grain storage. Other cattle, including dairy cows, and sheep are primarily consumers of forage.

Nevertheless there are fewer differences among livestock classes in the stabilizing value of feed-grain storage than these figures would suggest. Grain can always be substituted for forage to considerable extent. Storage of grain thus helps to offset variations in the supply of forage, and therefore indirectly aids in stabilizing forage-consuming livestock. Moreover, the rate of feeding grain and other concentrates per head of livestock is a major short-run influence on output of several livestock products—

[2] See *Reserve Levels for Storable Farm Products*, Senate Doc. 130, 82d Congress, 2d Session. Cf. especially "Regional differences in livestock and feed production and in feed requirements," p. 35; and "Differences in effects of feed grain supplies upon various farming types," p. 37.

milk most of all. Hence, stabilizing the supply of feed grains helps greatly to stabilize the production of those products.

Farmers who produce and feed their own grain are probably less conscious of the price of feed than are farmers who buy most or all of their feed. The Midwest is the chief surplus producer of feeds. The region is likely to have enough feed for its own use in below-average crop years, and it can be a first claimant on much of its own supply. The East, South, and West are feed-deficit areas.

It is difficult to generalize the effects of feed programs on a regional basis. However, it would appear that in the Midwest, where livestock producers are likely to think as much in terms of the supply of feeds as of their prices, storage and price programs for feed would have a marked effect in stabilizing livestock production. Influenced most would be the up- and down-swings in hog production. In the East and perhaps the Southeast and the West Coast, which are primarily dairy-poultry regions, some added stability of output would result but chiefly there would be relief from the price and income effect of alternate high and low feed prices. These latter regions have usually held up output fairly well year after year, but have seen their net incomes narrowed sharply in years of high prices for feed.[3]

These remarks are not to suggest any differences in the long-time average level of returns to livestock producers in feed-deficit versus feed-surplus areas, or in one kind of livestock production versus another, either with or without a feed program. After a time, any livestock enterprise adjusts to competitive costs in such a way as approximately to equate net returns. Differences between producers or areas are short run differences.

Apart from the greater stabilization of livestock output and price, notable improvements result from feed storage in other ways. Particularly is there an enhanced efficiency in using feed, labor, buildings, and other input items in livestock production when feed prices and therefore the size of livestock operations are afforded some stability.

Varying Demand

When consumer demand for livestock products varies, the effects of feed-supply programs take on a different character. For in this case the stabilizing influence of the feed-storage program is complicated, with varying consequences, by the unstabilizing influence of the changes in demand.

If demand *increases* sharply, reserves of feed at a comparatively stable

[3] Prices of feed in these regions, especially of commercial mixed feed, do not vary as sharply as do feed prices in the Midwest. Nevertheless they have changed enough in short- and big-crop years to cause profit squeezes and bulges.

price are of definite assistance to livestock producers. This was well demonstrated at the beginning of World War II and again at the beginning of the Korean conflict, when feed reserves facilitated quick expansion in livestock production. In effect, livestock producers prosper from the expanded demand and consumers benefit from the increased supply of livestock products; but producers of feed receive at the time little extra return from it.

When consumer demand *decreases* because of a business recession the effects of a price-support program for feed grains are opposite. Producers of feed grains are partially insulated from the weaker demand, but livestock producers are forced to adjust to it. They find it necessary to pay prices for feed grains nearly as high as before.[4] It is in this situation that livestock producers, principally producers of grain-consuming livestock in grain-deficient areas, are most vulnerable to a price pincers. Without a feed-support program, the effects of weaker consumer demand would be passed back to producers of feed in the form of lower prices for feed; under a feed program, livestock producers are caught between declining prices for their product and less reduced prices for feed, and are forced to adjust their output to the new price relationship.

After adjustments to new conditions of demand are made, prices of livestock products are higher than they would be in the absence of feed storage. The contractions in livestock output tend to restore prices of livestock products. In this sense there is some ultimate benefit from feed programs after the adjustment process is over. But though price may be held up income is not, as the volume of production and marketings is lower than it had been.

Livestock producers whose products receive some price support—chiefly dairymen and wool producers—are not required to make such a difficult adjustment when demand declines. It is the hog and poultry producers and the cattle and lamb feeders who are caught most tightly in the temporary squeeze between declining selling prices and less flexible feed costs.

Cycles in Livestock

In addition to the instability that arises from fluctuating supplies and prices of feed and from unsteady demand, there is a cyclical variability caused by leads and lags in production adjustments within the livestock industry itself. The long period of time that elapses between a production

[4] Prices of feed grains, when supported, change slowly because (1) the parity index, which determines the support price, changes slowly; (2) support prices, annouced a year in advance, can be adjusted only at yearly intervals. In commercial mixed feeds the tendency toward constant charges to mixers and distributors also impedes rapid price changes.

decision (as for breeding) and the consequent marketing gives a cyclical pattern to most adjustments in livestock. The longer the natural biological period, the longer and more obvious the cycle. In chickens adjustments are made quickly. In cattle, which have a long life span, there is a long cycle.

Cyclical changes in livestock production when prices of feed grains are stabilized have effects that are much the same as those caused by changes in demand. When production has expanded cyclically and livestock producers find their selling prices lower but the price of feed unchanged, they experience a price-cost squeeze like that which results from declining consumer demand.

Abandoning price programs on feed would not avoid the damage from livestock cycles, except temporarily, at times. When there are no feed programs, prices of feed do not move up or down sympathetically with cyclical changes in livestock production; cyclical livestock-feed price squeezes occur then too and livestock production adjustments are required just as they are when feed programs are operating.

Long-Time Levels

An additional consideration is whether the long-time level of livestock production is higher or lower because of price-support and storage programs for feed. The above comments have been directed to the question of short-time fluctuations and their possible moderation.

The height of price supports on feed grains determines their overall effect on the volume of livestock production. Should supports be so high as to restrict the livestock industry and require acreage allotments on corn, the total output of livestock would probably be smaller than under no supports or lower supports for feed. Supporting prices of feed grains at low levels would certainly not restrict livestock output and might give a small net expansion. There might be less stability if too little reserve should be built up to meet needs in short-crop years.

There is evidence that the certainty given feed-grain prices by supports while most livestock prices are not supported may encourage more storage of grain and result in a slightly smaller livestock production than would take place under the same but unsupported feed prices. In 1953, for example, fewer pigs were raised than would have been expected from the high hog-corn price ratio of that year. Apparently relatively assured prices for corn but less assured prices for hogs tend to hold production of hogs below what it would otherwise be whenever producers lack confidence in the price outlook for hogs. But at times of greater confidence, price supports for feed have little if any extraordinary effect on the volume of production of hogs or other livestock. The apparent influence of a grain-

support and storage program in shrinking livestock production slightly during times of uncertainty may be regarded as favorable or unfavorable depending on what the objectives in livestock production and prices are held to be.

Summary

In summary, livestock producers appear to be better off because of price and storage programs for feed grains than they would be without them. Having a stable supply of feed available at comparatively stable prices helps livestock producers to achieve a fairly high degree of short-run stability in their operations during a period when consumer demand is unchanging; and it aids them greatly when a sharp increase in demand calls for a stepped-up livestock output. These advantages appear to outweigh the disadvantage in which many livestock producers find themselves when demand declines, when they are squeezed between a falling price for their product and relatively firm prices for feed—a price squeeze that lasts until the level of production is adjusted sufficiently to restore a more nearly normal product-feed price relationship.

HAROLD F. BREIMYER

Agricultural Marketing Service

THE EFFECT OF A DECREASE IN THE PRICE OF BUTTERFAT ON THE RELATIVE PROFITABILITY OF TYPE OF DAIRY COW

THERE is considerable speculation that even with the continuation of a price support program for dairy products, with some flexibility in the level of support, the price of butterfat will ultimately decline relative to other dairy products. That prospect is not the topic of this analysis. The effect of such a price change, should it occur, on the relative profitability of different levels of butterfat production is considered.

For plants which are not selling any of their product in the form of butterfat the effect of such a change would depend upon how much shifting in utilization of milk results. If the price of butterfat decreases, many plants will shift milk utilization from the manufacture of butter (and nonfat solids) to the manufacture of cheese (or other products). This will increase production and can be expected to depress cheese prices. Lower cheese prices will mean lower milk prices to the producers who sell milk for cheese utilization. In this way a decrease in butterfat price can result in lower milk prices in other utilizations, as well as the initial decrease in price for milk going into butter-powder utilization. This decrease in price would apply equally to all tests of milk in a cheese utilization, of course, because the basic 3.5% price and the differential for every .1% deviation from 3.5% test are both determined primarily by the price of cheese rather

than the price of butterfat. The only situation in which a decline in butterfat price can appreciably affect the price of high-test milk more than the price of low-test milk is when a considerable portion of the plant's income is derived from the sale of butterfat (in the form of fluid cream or butter).

Probably the most common interpretation of the result of a decrease in the price of butterfat is that it will decrease the differential paid for every .1% deviation in fat test from 3.5%. This in turn is expected to place high-test producers at a relative disadvantage. If butterfat itself is one of the products sold by the plant, the differential will be reduced when the price of butterfat decreases. At the same time, however, the total amount of money to be distributed among producers will also be decreased. This will result in a lower price for the average test and so a lower basic price for 3.5% milk to which the smaller differential is applied to determine the price to be paid for milk testing above or below 3.5%. Although the differential may be decreased slightly more, percentage-wise, than the basic price, the major effect of a decline in the price of butterfat will be a general reduction in the price of milk of all tests.

For an illustration of the effect a decrease in the price of butterfat would have on returns to different producers, such a price change has been traced through the pricing structure of a plant which manufactures butter and nonfat dry milk solids. A plant of this type has been used which handled 3,000,000 pounds of milk in a two-week period of operation. With butter priced at 68¢ per pound and nonfat dry milk solids at 17¢ per pound this plant could pay $3.50 per hundredweight for 3.5% milk with a differential of 8.4¢ for every .1% deviation from that test on a fat and solids-not-fat basis of payment.

With butter priced at 55¢ per pound and the price of nonfat dry milk solids at 17¢ per pound the impact of the change would be substantially the same for all three producers, as shown in Table 1. The major effect is a large decrease in returns to cows at all test levels because, while the differential paid for .1% deviation from a test of 3.5% decreases from 8.4¢ to 6.8¢, at the same time the basic price for 3.5% milk also decreases from $3.50 to $3.01 per hundredweight. This would reduce returns to labor slightly more in high-test production but the major impact would be a reduction of approximately 40% in return to labor for all three types of cow.

It would require an increase in price of nonfat dry milk solids from 17¢ to 23¢ per pound in order to offset this decrease in butter price and maintain the same basic price of $3.50 per hundredweight for 3.5% milk. In this case the differential paid for every .1% deviation from 3.5% test would be decreased from 8.4¢ to 7.0¢ because lower butter price would reduce the value of high-test milk more than the higher nonfat dry milk solids price would increase it. This would reduce the returns to high-test cows but

TABLE 1. EFFECT OF PRICE CHANGES IN A BUTTER-POWDER PLANT ON PRODUCER RETURNS

Cow with butterfat test of:	Return to labor per cow*		Return lost with butter 55¢ S.N.F. 17¢	Return to labor per cow with butter 55¢ S.M.F. 23¢	Return lost with butter 55¢ S.N.F. 23¢
	Butter 68¢ S.N.F. 17¢	Butter 55¢ S.N.F. 17¢			
3.5%	$152.82	$91.91	40%	$152.82	00%
4.8%	139.30	80.26	41%	124.12	11%
5.3%	133.37	76.20	43%	115.05	14%

* These calculations are based on barn feeding of hay and concentrates. They can be transferred to any type of farm feeding practice by considering that a portion of the hay is obtained from pasture. While from 4½ to 7 tons of hay per cow has been used (3 pounds hay per hundred pounds of body weight per day), many farmers only feed about 3 tons of hay. The difference is made up from pasture. Similarly, if some of the roughage is in the form of corn silage, 3 pounds of silage can be substituted for each 1 pound of hay to be replaced. If appropriate charges are made for the silage and pasture use, costs will not be changed significantly. The amounts of concentrates fed was calculated to make up the nutrients required for maintenance and production, assuming cows weighing 1,300 pounds, 1,000 pounds and 900 pounds respectively and all three of equal product efficiency (30% of feed energy intake transformed into milk energy output).

Returns include both milk and veal production. Costs include all costs of: housing, breeding, insurance, veterinary, etc. ($60 per cow per year adjusted for differences in cost of housing due to differences in size of cow); handling, cooling and holding milk (12¢ per hundredweight); hauling milk (18¢ per hundredweight), and; the cost of raising calf up to veal weight.

leave returns to 3.5% producers unchanged. (Returns to cows producing below 3.5% test would be increased correspondingly.) Since an increase in the price of nonfat dry milk solids does not appear to be in prospect it is unlikely that such relative price changes will force any breed out of dairying.

In this conclusion it should be emphasized that availability of roughages and labor on the farm, type of milk market and distance from that market are major factors in the economic choice of type of dairy cow for any particular farm. Similarly, in any farm situation, high productive capacity is the key to profitable dairying with any breed or type of cow.

SYDNEY D. STANIFORTH

University of Wisconsin

AMOUNT AND SOURCE OF SHRINK AND FILL IN MARKETED HOGS*

ACCURATE measurements of the amount and nature of the loss in weight which hogs undergo while being trucked to market and also on the amount and nature of gains made by hogs in terminal markets, from the time of arrival to the time of sale, are generally not available. How variable is shrink and fill from day to day? Is it different for each of

* Journal Paper No. J2517 Iowa Agricultural Experiment Station, Ames, Iowa, Projects 1005 and 1230. This study was initiated and financed by the Chicago Union Stock Yard and Transit Company.

the U. S. choice grades? Does the commission firm have an effect on amount of fill?

In order to obtain some information on these and related questions, additional data were obtained during an experiment on prices paid for hogs of the several U. S. Choice grades.[1] The data consisted of the weights of 72 lots of hogs taken (1) when they were loaded on trucks at a distance of 160 miles from Chicago, Illinois, and (2) when they were sold. Each lot contained about 18 hogs. Lots were either all No. 1's, all No. 2's, all No. 3's or a mixture of ⅓ each of No. 1's, No. 2's, and No. 3's (called grade 4). There were 18 lots of each of the four types; 6 lots of various grades being sold each of 12 different days during the period, January-February, 1953. The lots were sold under fictitious names so their identity as test lots was unknown to the buyers. The lots were assigned, by a scheme of randomization, to 12 different commission firms. The changes in weight of the 72 experimental lots of hogs are given in Table 1 where they are arranged by day number (1 to 12), firm (A to M) and grade (1 to 4).

These data were analyzed in a manner similar to the price data of the aforementioned article, in two stages: (i) estimation of differences in weight changes of the hogs in the four grades and (ii) estimation of differences in weight changes of the hogs marketed on different days and by different firms.

It seems reasonable to expect that hogs in the several grades should show about the same weight changes. This is borne out by an analysis of the data in Table 1. If each line of Table 1 is called a "transaction" then we group the 24 "transactions" according to grades similar to that shown in the analysis of prices in the previously mentioned article. The following differential weight changes are estimated for each grade:

Grade	1	2	3	4
Differential weight change	− 0.04	+ 0.13	− 0.41	0.23

These values are so small they have no practical or statistical significance, the latter being confirmed in the analysis of variance set forth in Table 2.

Since the between grade mean square is smaller than the mean square for replicates and is not statistically significant, no adjustments for grade differences are made in the subsequent analysis. Apparently, the observed differences in net weight changes between grades can be attributed to random fluctuations. The mean square for "transactions" being a mixture of commission firm and day differences is on the border line of statistical significance (just insignificant) when tested against either the replicates —or the transaction-by-grade component. If, however, replicates, grades

[1] E. S. Clifton, R. J. Jessen, and E. M. Jacobs. "Marketing Hogs on the Chicago Market." *This Journal*, November, 1954.

TABLE 1. NET CHANGE IN WEIGHT PER HOG FROM ORIGIN TO TIME OF SALE FOR EACH OF THE 72 EXPERIMENTAL LOTS (REP. = REPLICATE)

Day Code-Date	Comm. Firm (Code No.)	Grade 1 Shrink+Fill		Grade 2 Shrink+Fill		Grade 3 Shrink+Fill		Grade 4[a] Shrink+Fill	
		Rep 1 (lbs/hd)	Rep 2 (lbs/hd)	Rep 1 (lbs/hd)	Rep 2 (lbs/hd)	Rep 1 (lbs/hd)	Rep 2 (lbs/hd)	Rep 1 (lbs/hd)	Rep 2 (lbs/hd)
1 (Jan. 13)	A	9.34		1.58	0.79				
	B	−2.18						−0.67	0.66
2 (Jan. 14)	A	1.11		1.50	2.10				
	C	0.50				−0.67	−1.18		
3 (Jan. 15)	D	2.11	4.29	4.00					
	E			3.69		−2.06	−3.00		
4 (Jan. 20)	E			−3.00		−0.93	−0.56		
	F			0.00				2.00	0.83
5 (Jan. 21)	G			0.71	1.05	0.26			
	H					0.00		1.38	0.00
6 (Jan. 22)	J	−1.31	−0.75					−1.95	
	K			−1.91	−0.24			−1.11	
7 (Jan. 27)	L	9.72	1.84			1.66			
	H					−1.84		−2.50	1.30
8 (Jan. 28)	K			−0.50	−1.19			0.84	
	M					−1.94	−2.00	0.00	
9 (Jan. 29)	L	−2.25	−2.14			−0.92			
	G			2.75	−4.52	−1.43			
10 (Feb. 3)	J	0.27	0.50					−1.11	
	M					0.96	3.34	0.83	
11 (Feb. 4)	C	−2.10				1.58	1.91		
	B	0.24						−0.84	−0.27
12 (Feb. 5)	D	−0.26	0.59	0.55					
	F			0.00				3.33	−4.17

[a] Grade 4 consists of equal numbers of grades 1, 2 and 3.

and grade-by-transaction components are pooled, they form a "within transaction" component with a mean square of 4.5219 based on 48 degrees of freedom. Tested against this, between-transactions is statistically significant. It appears worthwhile, therefore, to investigate the between-

TABLE 2. ANALYSIS OF VARIANCE FOR DIFFERENCES BETWEEN GRADES

Source of Variation	Degrees of freedom	Mean square
Between hogs of same grade in a transaction (replicates)	24	4.35
Between transactions	23	8.57
Between grade (pairs)	6	2.25
Grades×transactions	18	5.50

transaction mean square further in analysis (ii), in which the effects of "firms" and "days" are separated. This is done to determine (1) if some firms appear to consistently get a better fill on their hogs than other firms and (2) if the weight changes are related to the day that they were shipped.

The 24 means are arranged in 4 "quarters" of 6 means, each "quarter" dealing with the transactions of 3 firms on 3 days. Regarding each

"quarter" as an Incomplete Randomized Block design and pooling corresponding mean square from the 4 "quarters" the Analysis of Variance table shown in Table 3 is obtained.

Testing the between firm mean square against the replicate mean square, 4.35, of Table 2 a statistically significant result was obtained but when testing against the Remainder mean square, 5.70, the F-ratio was not statistically significant. This may be due to a small number of degrees of freedom (only 4) in the latter mean square. These tests suggest that there are differences in the weight changes of hogs handled by different firms on a given day but that these weight changes do not appear to be consistent from day to day. The tests for differences between days are very similar and indicate that there are differences between the average weight changes of hogs transported on different days but that these differences vary somewhat from firm to firm.

TABLE 3. ANALYSIS OF VARIANCE FOR DIFFERENCES BETWEEN FIRMS AND DAYS

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Between transactions	23	197.00	8.57
Between quarters	3	12.59	4.19
Within quarters	20	184.42	9.22
Between days, ignoring firms	8	61.67	7.71
Between firms	8	99.93	12.49
Remainder	4	22.81	5.70
Between firms, ignoring days	8	73.92	9.24
Between days	8	87.71	10.96
Remainder	4	22.78	5.70

The average weight changes on the 12 different days (corrected for firm differences) are shown in Table 4 with the temperature highs observed on the particular 12 days on which the sales took place. (The temperature highs were obtained from published newspaper reports for Chicago).

When a linear regression line is fitted to the data in Table 4, with the temperature highs as the independent variable, the following equation was obtained:

$$y = -3.30 + 0.09\ (\pm 0.03)\ x$$

where y is weight change, x is the temperature high, and ± 0.03 is the standard error of 0.09, the estimated regression coefficient. The regression is statistically significant (the correlation coefficient is 0.71). According to this equation, hogs on the average have undergone no weight change at a temperature high of about 37°F. At 26° a loss of about 1 pound per hog and at 48° a gain of about one pound per hog was observed.

This experiment was conducted during cold weather (temperature highs

TABLE 4. AVERAGE WEIGHT CHANGES AND TEMPERATURE HIGHS OBSERVED ON THE 12 DAYS OF THE INVESTIGATION

Date of Sale	Weight Change (lbs. per hog)	Temperature High(F°)
	y	x
Jan. 13, 1953	1.59	49
14	.30	47
15	1.67	56
20	.66	35
21	1.23	46
22	−1.11	37
27	1.61	38
28	−1.16	29
29	−1.55	24
Feb. 3	.46	34
4	1.46	47
5	−0.48	46

of 24° to 56°F). It is expected that extremely hot weather would result in large shrinkage as well as excessively cold weather. This study points out the need for careful observations of temperature in future shrink studies.

Conclusions

When hogs were shipped by truck 160 miles in relatively cold weather and then fed and watered before they were sold, it was found that:

1) Hogs of different grades "shrunk" by the same amount.
2) Amount of shrink differed from firm to firm on a given day but there is no evidence of persistent firm effect on "shrink" through time.
3) Amount of shrink differs from day to day, independent of firm. This appeared to be due to temperature differences.

E. S. CLIFTON, R. J. JESSEN AND E. M. JACOBS[2]

Iowa State College

[2] The authors acknowledge the assistance of the following people in conductinug the study and preparing the manuscript: W. Lyle Fitzgerald, Agricultural Economist, Chicago Union Stockyards and Transit Co.; Allan Nash, retired hog buyer, Wilson and Co., Inc.; James R. Wiley, Prof. of Animal Husbandry, Purdue University, and H. A. Hartley, Prof. of Statistics, Iowa State College.

DISTRIBUTION AND USE OF IRRIGATION RESEARCH RESULTS

THE SOCIAL scientist usually is uncertain as to the use made of his research. His findings are published and distributed through the customary channels, and often he hears nothing more about the outcome of his efforts.

Recognizing this problem, as well as the need for more explicit guides to the dissemination of research findings, the authors made a check of the distribution of two reports published by the Montana Agricultural Experiment Station.[1] These publications were a technical bulletin and a popularized circular relating to the same study. The reports were released in January 1952. Since that time, the Station Editor has filed all written requests for these reports and this note is based primarily on an analysis of these requests.

The Publications

The two reports are:

1. Clyde E. Stewart and D. C. Myrick. *Control and use of resources in the development of irrigated farms Buffalo Rapids and Kinsey, Montana.* Mont. Expt. Sta. Bull. 476.
2. Clyde E. Stewart and D. C. Myrick. *Irrigated farm development in Buffalo Rapids and Kinsey, Montana.* Mont. Expt. Sta. Cir. 195.

The study reported in these two publications was concerned with the problem of control and use of resources in the development of new irrigated farms. Rate of development was an important feature of the study. The success of various kinds of development situations was determined, and methods used were compared. Analysis was made of the nature and merits of alternative policies and programs. Implications were considered in terms of new areas.

These reports deal with a specialized kind of agriculture. Irrigated farming comprises a relatively small part of all agriculture, both in the United States and throughout the world. This setting is especially significant to a consideration of the demand for publications concerning irrigation.

The Initial Distribution

Initial distribution was made shortly after the reports were off the press. As usual, both reports were subsequently announced in lists of new publications. Radio releases, newspaper accounts, and articles based on the study were prepared and disseminated.

Initial mailing comprised about 2,800 copies of the bulletin and 2,500 copies of the circular. The bulletin is used to illustrate the composition of this distribution (Table 1). The Montana Agricultural Experiment Station mailing list includes standing requests for all publications. But much of the initial distribution represents requests that were made specifically for bulletin 476.

The largest aggregate distribution was to the County Extension Agents in Montana. The next largest was to libraries in Montana, elsewhere in

[1] This survey was suggested by Harry Steele, Production Economics Research Branch, Agricultural Research Service, U. S. D. A., Lincoln, Nebraska.

the United States, and Canada. Agencies such as the then Bureau of Agricultural Economics, the Bureau of Reclamation, and the State colleges of North and South Dakota requested substantial quantities for their personnel and other interested persons. Vocational Agricultural instructors, County Agricultural Conservation committees, employees of the Farmers Home Administration, and other agricultural specialists in Montana received the reports in relatively large numbers. Individuals in widely scattered countries were also on the mailing list to receive these publications.

TABLE 1. INITIAL DISTRIBUTION OF MONTANA AGRICULTURAL EXPERIMENT STATION BULLETIN 476, JANUARY 1952

Addressees	Number
Libraries—Montana, U. S., and Canada	400
Experiment station directors	65
Newspapers & magazines—Mont., U. S., & Canada	125
U. S. Bureau of Agr. Econ.—Washington & Field	290
U. S. Bureau of Reclamation	150
South Dakota Experiment Station	200
North Dakota Experiment Station	100
Agricultural specialists in Montana[a]	300
Montana Experiment Station Staff	150
Cooperating farmers	75
Individuals—U. S., South America, Canada, Cuba, Puerto Rico, Philippines	205
Others, including supplies to 51 County Agents[b]	740
Total initial distribution	2,800

[a] Excluding County Agents and personnel at the State College.
[b] Also farmers' mailing lists in 6 Montana Counties.

It is evident that many people who logically would be interested in these publications got them as part of the initial distribution program. In fact, at that time a special effort was made to reach possible users. Particularly in the professional field, subsequent calls for the reports were probably reduced by this initial mailing. The bulletin files of libraries meet much of the demand of people interested in the economics of agriculture and irrigation.

Many farmers in Montana received the reports through direct mailing or from their county agents. The mailing list included farmers in three counties who cooperated in the study. Farmers' mailing lists were also used for six counties in Montana where prospects for irrigation development were especially good. Two large irrigation projects are now in the construction stage in these counties.

Number of Requests

From January 1952 to October 1953, written requests were received for

277 bulletins and 261 circulars, or a total of 538 copies (Table 2). These requests were made by 98 people; the circular and the bulletin received about the same number of requests. As a general rule, people did not ask for both publications.

In addition, about 250 copies of each report were given out to people who contacted the Station Editor or the authors in person. These quantities are not included in the distribution figures presented elsewhere. A more accurate record of oral requests would have been helpful to this summary.

TABLE 2. MAIN GROUPS WRITING FOR MONTANA AGR. EXPT. STA. BULL. 476 AND CIR. 195, JANUARY 1952—OCTOBER 1953

Group	Bulletin	Circular	Total
	Number	*Number*	*Number*
Private individuals	8	10	18
Private businesses	8	5	13
Outside United States	20	12	32
Extension Service	118	206	324
Colleges and Universities	83	16	99
U. S. Federal Agencies	40	12	52
Total	277	261	538

Requests by Individuals

Few private individuals requested the Buffalo Rapids publications from the Station Editor. Individuals who wrote for the reports lived mainly outside the state from California to Maryland. Most farmers requested the reports through their county agents.

Settlers coming to new irrigation projects usually are from widely scattered sections of the country. A problem is posed as to how these people can learn about and obtain available reports and information concerning settlement problems. The Bureau of Reclamation receives most of the inquiries about specific projects and prospective settlers are supplied with considerable information by this agency. Additional opportunities to expand the service through this agency and other outlets may arise.

Requests from Outside the United States

Requests were received from people in 14 countries. These requests were made by 22 individuals, mainly in countries in which irrigation is practiced. Except for Portugal, there were no requests from European countries. A relationship between requests and resource development programs of our own country may have existed also. A substantial number of persons in foreign countries are on the Station mailing list (Table 1).

Sources of requests for these publications represented a wide geographic distribution throughout the world. The number of requests from foreign

countries was small. But presumably most of those who requested the reports hold positions of importance in resource development in their respective countries.

Other Characteristics of the Requests

A fundamental difference existed between the circular and bulletin among the main requesting groups. The Extension Service, mainly county agents, asked for nearly twice as many circulars as bulletins. The personnel of Colleges, Universities, and federal agencies asked for several times as many bulletins as circulars. These relationships conform to expectations.

About 73 percent of the written requests for both reports in terms of numbers were made during the first 3 months after publication. These requests were made primarily by county agricultural agents in Montana who had been sent a substantial number of the reports and who requested additional copies. Requests were received in nearly all months of the 2 years.

We have seen that the initial distribution included 125 newspaper and magazine companies in the United States and Canada. Several businesses requested copies of the reports. These companies included farm magazines and corporations engaged in handling and manufacturing sugar, grain, soup, chemicals, and containers.

Conclusion

A large proportion of the farmers within the state of publication do not hear about studies that have been conducted. Unlike professional people, the chances are small that farmers outside the state will learn of these studies or reports. Research frequently has application in more than one state and the effective utilization of research findings is contingent on their use in wide geographic areas.

Individual research efforts may have substantially greater influence than is supposed or evidenced. The writers of this note believe that researchers need to give more attention to the narration and distribution of research findings with a view to improving their usability and application. It is apparent that specialized information can be brought to the attention of farmers mainly through county agents and various action program representatives who are in direct contact with farm people. A part of a researcher's job, therefore, should be to present his information so that it can be readily transmitted by personnel of extension, education, and action agencies.

CLYDE E. STEWART
D. C. MYRICK

Agricultural Research Service

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"Unemployment and Partial Employment of Hired Farm Workers in Roswell and Artesia, New Mexico May 1951—May 1952," U. S. Dept. of Labor, Bur. of Employment Sec. in Coop. with U. S. D. A., Agr. Res. Serv., April 1954.

"Unemployment and Partial Employment of Hired Farm Workers, Selected Areas of Louisiana," Eleanor M. Birch and Joe R. Motheral, U. S. D. A., Agr. Res. Serv. and U. S. Dept. of Labor, Bur. of Empl. Sec., June 1954.

"Wool Program," Hearings Before the Committee on Agriculture, House of Rep., 83rd Cong., 2nd Session on H. R. 7775, Serial Y., March 4-5, 1954.

BOOK REVIEWS

Farm Management Economics, Earl O. Heady and Harald R. Jensen, New York: Prentice-Hall., 1954. Pp. 645.

It no doubt appeared to many that with the publication of *The Economics of Agricultural Production and Resource Use,* the group led by Professor Heady had made its greatest contribution to agricultural production economics, at least as far as the written word is concerned. *Farm Management Economics,* however, proves that this was not the case. For here truly is a presentation for the great unwashed, or semi-washed; or, to use biblical terms, here is a "gospel for the gentiles."

Up to this point, the written word of the Heady group has, in general, still been rigorous enough to scare off some who scorned "theory," or who felt they sought a "more practical" approach. *Farm Management Economics,* while losing none of its basic integrity, is simple enough for nearly any college student. At the same time, its subject matter is such as to display vividly the extremely "practical" nature of the approach taken by Heady and his colleagues.

Heady and Jensen have designed the book as a text for college courses in farm management, and as a general reference for use by any individual interested in the production side of agriculture. The central portion of the work is devoted to planning and budgeting the farm business. Throughout these eleven chapters, one will find a large part of the production function data now available with respect to livestock and crop production. Many illustrations are given as to how this and similar data may be used in the farm management decision making process. From a pedagogical viewpoint, this is probably the outstanding contribution of the book.

Toward the end of the work are chapters on adjusting to risk and uncertainty, including a discussion of insurance; farm prices and outlook; leases and rental agreements; farm credit, and buying a farm. These serve to round out the discussion of farm operation and organization. In the introductory chapters, attention is given to the field of farm management, systems and locations of farming, and an excellent chapter entitled "Farming: its income and requirements." Chapter 4 is a discussion of the basic economic principles particularly applicable to farm management. Here, in approximately 40 pages, the authors give a simple but effective summary of a large portion of the theory upon which their analytical system is built.

It is probably quite fair to say that Heady and Jensen offer nothing new in *Farm Management Economics.* In fact, the whole system or vintage of production economics which they represent offers, in actuality, nothing

really new. Yet such a statement is not at all pertinent to the excellence of their contribution. In the opinion of the reviewer, *Farm Management Economics* is the finest general farm management text which has yet been published. No doubt, as time progresses, others will surpass it. But it has a completeness, an up-to-dateness, internal consistency, and an overall usefullness which places it in the highest category among existing books of a similar nature.

College teachers of farm management will want to give *Farm Management Economics* particularly close attention. It is difficult for most farm management teachers to find a book to their liking. Yet in most courses, a text can be helpful if an adequate one can be found. While this work is perhaps best adapted to the cornbelt, there are enough illustrations and data which apply to other regions to give it much wider appeal. There is far too much material in the book to be covered in a single semester. It could easily provide reference material for two undergraduate courses. And while the authors indicate that it is simple enough for freshmen, this may be stretching the point a little in places. The chapter on principles, for example, will even give a little trouble to those seniors (and they are plentiful) who find it an effort to think in terms of ratios. But any good text should offer a challenge, if it is to add to a student's understanding and knowledge.

Probably the main weakness of the book is in its organization, particularly within chapters. It has a tendency, at times, to ramble. Had the authors devoted more effort to organizing individual chapters on a somewhat tighter basis, the book might have been made a good deal easier for undergraduate students.

The market for this work, however, will not be limited to academic circles. There will be large numbers connected with farm management in other ways who will find it to their advantage to study *Farm Management Economics*. Unlike many farm management texts, it holds a promise of appealing to even farmers themselves.

JOHN W. HICKS

Purdue University

The Flood Control Controversy, Big Dams, Little Dams and Land Management, Luna B. Leopold and Thomas Maddock, Jr., New York: The Ronald Press Company, 1954. Pp. xiii, 278. $5.00.

This book was sponsored by The Conservation Foundation. The purpose, as stated by the authors, ". . . is to clear up some of the misconceptions formed by the public as result of hitherto inadequate discussion of the elements of a flood control program." While the authors motivated their discussion around the controversy growing out of the upstream program as

carried on by the Department of Agriculture and the downstream program of the Corps of Engineers, they also considered other controversial features of the flood control program. The book carefully reviews the hydrology of floods and rivers to provide a background for considering the accomplishments and limitations of the land management practices of the Department of Agriculture and the downstream engineering structures of the Corps of Engineers.

In developing the controversy, the authors began with the 1936 Flood Control Act, which put both agencies in the flood control business without precisely defining their respective areas of responsibility, and also, except for the requirement of a favorable benefit-cost ratio, without laying specific ground rules for the operation.

So long as the Department of Agriculture confined its activities to land management practices, as it did for some years after 1936, there was harmony between the agencies and the proponents of their respective programs. However, as more experience was acquired it became more and more obvious that the land management practices of the Department of Agriculture were relatively ineffective in controlling floods. For this reason, the Department turned to small water retention dams. The adoption of such engineering practices, in the absence of clearly defined geographic areas of responsibility, put the Department of Agriculture in direct competition with the Corps of Engineers. In addition to the competition for specific projects, they competed for benefits to justify their respective programs. They also competed for limited funds available for flood control work. The fact that they followed quite different hydrologic and economic procedures in planning their projects and also used different design criteria did not serve to lessen the conflict.

The various pressure groups found it advantageous to align themselves with one side or the other of the controversy. The residents of the populous downstream areas who wanted immediate flood protection found it desirable to back the program of the Corps of Engineers. They could see real benefit from local storage and levee construction. On the other hand, the individuals who would be displaced by the reservoir found it to their advantage to support the upstream program of the Department of Agriculture. The upstream program also had certain conservation aspects which appealed to conservation groups.

After developing the basis of the controversy, the authors proceeded to show that so far as the actual program was concerned, there was actually no conflict. They pointed out that while the upstream land management programs and small dams were effective in land development and would provide local flood control, they were relatively ineffective in providing flood control in the more populous downstream areas. Therefore, the two

programs so far as flood control is concerned are complementary rather than competitive.

Having reached this conclusion, the authors went on to point out that the controversy has developed because of the nature of the problem rather than because of the divided responsibility between the two principal agencies. They indicated:

". . . the solution of the problem does not lie in organizational changes. Placing all flood control activities under a single agency, for example, does nothing to reslove the basic deficiencies in techniques, in data, and in experience, but simply submerges them.

". . . In a single organization the conflict would still exist, but it would then be between persons or groups instead of between agencies. Under such conditions, the development of a flood control program would be guided by the strength, forcefulness, and ability of those who dominate the organization. Thus, what might appear to be an integrated program might not be one at all, and, lacking any sort of critical review and analysis, it might never be subjected to scrutiny." (p. 237).

After pointing out that the upstream program of the Department of Agriculture was largely a land development program, the authors took occasion to indicate that it was hardly appropriate to carry out such a land development program under the guise of flood control. They also called attention to the inconsistency in the repayment requirements associated with that land development program in contrast to those associated with other land development programs carried out by the Federal Government.

I was more interested in their discussion of what I have thought of as the "paradox of flood control" than in their treatment of the "upstream-downstream controversy." While they did not fully develop the subject, they did comment upon the paradox at several points. A typical reference is in Chapter 8, where they indicated:

"Such examples indicate that flood control, as now practiced, tends to be self-perpetuating and even self-expanding. When a project is installed, there is a definite probability a flood will occur that will overtop levees or that will not be sufficiently reduced by reservoirs. As a result of development encouraged by a sense of security, the damage inflicted will be greater than would have been the case without the initial degree of protection. If this procedure were applied to all basins in the United States, one may argue that, given sufficient time, justification could be found to extend the degree of protection until it approached the limit of physical feasibility over a very large area. . . . (p. 131).

In their concluding paragraphs, the authors again returned to the subject and pointed out:

". . . Granting that attacking the major flood problems first is logical, the Corps has given practically no attention to nonengineering methods of reducing flood damage, particularly flood-plain zoning. In the short period the Corps of Engineers has been engaged in major flood control activities, it has spent, largely

between 1928 and 1952, about $3,600,000,000. It is incongruous that the Corps has made essentially no provision to restrict flood-plain development and the consequent increase in damageable values." (p. 247).

In my opinion the discussion of the paradox is the major contribution of the book. The authors might well have selected it as their central theme.

So far as I know, this is the first book of its type on flood control. The authors showed remarkable restraint and objectivity in their treatment of the subject. At times, the restraint was almost annoying. It is, however, a genuine contribution in the flood control field to students of either water policy or flood control procedure. So far as I am concerned, the book could have been improved by eliminating some of the procedural detail and duplication and by more elaboration of the problem of project formulation and selection. However, the relegation of the problems of project formulation and selection, which are largely economic, in a book of this type to a minor role is understandable.

J. KARL LEE

Bureau of Reclamation
Boise, Idaho

Regularization of Business Investment; A Conference of the Universities-National Bureau Committee for Economic Research, Melvin G. de Chazeau, editor, Princeton: Princeton University Press, 1954. Pp. xxvi, 511. $8.00.

This book contains papers presented at a conference held in New York City on November 23-24, 1951, "to broach the subject of what private businessmen can do towards maintaining high levels of productive employment." This conference was primarily an exploration of a new field. There is no air of finality in the papers; their points of view are many; no group of agreed-upon recommendations is presented.

The various authors have been assigned specific problem areas. Their papers are related but are essentially uncoordinated, and the organizational efforts of the editor neither contribute nor detract from the merit of the individual efforts, many of which could stand on their own feet. To judge from internal evidence, the organization of the book does not parallel exactly the organization of the conference.

The book is divided into three parts. Part I, "The Regularization of Investment by Individual Firms," contains capsules of information on the cyclical behavior of private investment by Millard Hastay and a discussion of capital rationing by Joel Dean, who shaped his concepts somewhat to the special point of view of this conference. Presumably these two papers could be skipped by those familiar with these subjects which are, of course, covered elsewhere. The introduction and article by the editor in Part I

cover the main subject of the volume quite adroitly and could be read advantageously by those who do not care to read the entire book. The second half of Part I consists of four case studies: building materials, petroleum, railroads, and electric utilities. They vary tremendously in organization and length, but all stress the practical and psychological difficulties inherent in proposals that private businessmen deviate from self-centered profit maximization to contribute in some small way to regularization of private investment.

Part II, "Selected Factors Importantly Affecting Regularization of Business Investment," contains an 80-page article by N. H. Jacoby and J. F. Weston, "Financial Policies for Regularizing Business Investment," which is noteworthy for its effective integration of statistical material, insight, and comprehensiveness. The authors call attention to findings in National Bureau studies that business firms experience an increase in idle cash balances during periods of business contraction and that financial institutions experience similar increases at the trough of cycles. They calculate that these balances are not enough to maintain an absolutely even level of business investment except perhaps among the very large firms but feel that a significant private contribution to regularization is at least possible. Their suggestions on how this might be accomplished in a manner compatible with individual profit maximization are thought provoking. For example, it is pointed out that a stable dividend policy aggravates cyclical swings in levels of investment, especially where internal financing is heavily favored, and they suggest an alternative policy.

Part III consists of short and desultory appraisal of the conference by three authors and is far from accomplishing the needed tying together of the many loose ends of this volume. It is unfortunate that no one undertook to answer "where do we go from here?" since this book ends much further than is common from a logical stopping place. Nowhere in the volume is there an adequate over-all evaluation of the material presented.

This book is not of particular significance for agricultural economists, but there are parts which would make useful additions to their stock of general economic information. For me, K. T. Healy's presentation on innovation and railroad investment in Part I, together with Yale Brozen's article in Part II on the impact of technological change, provided the most refreshing new insights.

It is of interest to learn of thinking on private contributions to economic stability. While most authors agree with Jacoby and Weston that something could be gained, private action is not advanced as a *sine qua non*. There is a good deal of uneasiness expressed over the role of government in any such program, and one is left with the impression that any governmental attempt to encourage private action (for example, by some kind of

dividend or inventory tax) would quickly become a hot political issue. Several authors pointed out, however, that many businesses have worked out systems to regularize their own production or investment to their own advantage, and it seems evident that, if the business community could be presented with workable plans, sooner or later they will be adopted by many firms.

The failure to mention the Farm Credit Administration in a list of government agencies concerned with credit (page 438) is an indication of the manner in which this volume ignores the existence of agriculture in the American economy and of the wide gulf which typically exists between those economists working primarily on general economic stability and agricultural economists. Certainly the problem of investment regularization is as appropriate to agriculture as to the business world, especially at this early stage, and there would be merit in dealing with agriculture in conferences such as the one which this book represents.

GUY BLACK

University of California
Berkeley, California

A *Century of Georgia Agriculture, 1850-1950,* Willard Range, Athens: University of Georgia Press, 1954. Pp. xii, 333. $5.00.

This is a well documented history of Georgia Agriculture covering major developments during the century 1850-1950. It parades facts in an orderly fashion giving the reader a better understanding of the economic, educational and political forces that influenced agriculture in Georgia and the Southeast. The author has skillfully sorted through the mass of available information and presented the more pertinent statistical data showing the economic status of farms in various areas of the state throughout the century.

The analysis is presented in three parts. Part One, *The End of the Golden Age, 1850-1865,* describes the Ante-bellum agriculture at its peak. Here one gains an appreciation for the Old South with cotton and the leisurely way of life. This Golden Age was hastened to its doom by war and strife between the States. Part Two, *The Long Depression, 1865-1900.* In this section the author reviews the efforts of individuals and organized groups who were in constant search for ways to restore prosperity to the States' agricultural systems. Most of these efforts were futile, leaving the masses of rural people with nothing but hope for a better way of life. Yet their hopes were never vanquished and it was in this period that the groundwork for progress in later years was laid. Part Three, *The Revolutionary New Century, 1900-1950.* The economic position of Georgia farmers improved with high cotton prices but the boll weevil dealt King Cotton a

mighty blow. The world wide economic depression that followed left Georgia farmers in a pitiful economic plight. The coming of the New Deal in 1932, with its agricultural reforms provided a temporary stimulant to the agricultural industry. World War II and the industrial development had tremendous influences on agriculture during the 1940-1950 decade. It was in this period that agriculture underwent rapid developments in mechanization, diversification and application of scientific methods.

The story of the development of Georgia Agriculture as told by the author, is one in which only a few farmers ever prospered from their agricultural pursuits. It depicts a few devoted leaders pleading and campaigning for agricultural reforms. The records show that many of the leaders never quite realized how to make the greatest use of Georgia's resources. Try as they did, "King Cotton" could never be dethroned. The author concludes that nowhere in the history of Georgia's agriculture can one find evidence of thrift and industry that characterized the development of agriculture in other areas. The ignorance of the masses steeped in tradition with gross indifference toward science continued to be a difficult obstacle to overcome in developing new farming systems resulting in a more profitable agriculture.

The industrial development in Georgia is fast overshadowing its agricultural interest, but the new generation of farmers are better educated and more willing to take and use scientific knowledge. With the assistance of research and extension activities, many farmers are developing profitable systems of farming which are strikingly different from the farming systems that prevailed prior to World War II. The large number of farms too small to make efficient use of machinery presents a difficult problem for profitable agricultural adjustments.

Students of Southern Agriculture will profit by a study of this book. The developments of Georgia's agriculture closely parallels the development of agriculture in other Southern states. An understanding of the forces that influenced agriculture in the past will better enable agricultural leaders and farmers to develop a more profitable agriculture in the future by adjusting to the continuous changes of economic conditions.

CHARLES P. BUTLER

Agricultural Research Service
Clemson, South Carolina

An Introduction to Statistical Science in Agriculture, D. J. Finney, New York: John Wiley & Sons, Inc., 1953. Pp. 179. $3.75.

In a very succinct manner the author discusses the following topics: the need for statistics, some problems of rates and frequencies, probability, properties and uses of distributions, an experiment to compare two varie-

ties, the reduction of error, factorial design, sampling, and correlation and regression. This book was developed from a course of eight lectures on statistical science to undergraduates reading agriculture at Oxford. Its object is "to impart a knowledge of the general principles on which statistical science is founded and of the manner in which it enters into so many agricultural problems." The procedure is one in which the logic upon which each of the techniques is based is stated explicitly and the mechanics illustrated by simple examples. Except for a very few simple algebraic formulae, no mathematics appear.

The basic techniques of statistical procedures discussed include the use of the mean and standard deviation for characterizing a set of measurements; the use of fiducial limits, standard error, Chi-square test, t test and F test in the estimation of population parameters; the use of regression coefficients and correlation coefficients with tests of significance for estimating parameters of relationships between variables; and the principles of design in sampling and experimentation.

The need for a treatment of these basic principles of statistics in such non-mathematical language is two fold: (1) a text for undergraduates in agriculture whose programs of study often contain very little mathematics; and (2) a reference for those persons who, already engaged in research, have had little if any statistics and mathematics in their past academic programs. Many undergraduates are not likely to become research workers. But in any event they are likely to find the need for using the results of research, and for keener observation and interpretation of everyday experiences. An understanding of results achieved by means of statistical description and analysis is essential. This book should not be too difficult for the undergraduate student in agriculture but eight periods of one hour each is likely to be much too short a time in our Schools of Agriculture.

This book was not designed to be used by the researcher as a substitute for the counsel of statistician. Rather, an understanding of its contents should indicate the need for such counsel and should prove to be a valuable means of more effectively seeking and using such counsel.

Many practical questions are likely to be directed at how much of the various inputs it will pay to employ in production. The discussion of regression is inadequate for what I would consider the minimum requirements in the undergraduate program. Moreover, there is a need for additional coverage of descriptive techniques used to characterize measurements, especially those distributions that fall into the non-normal categories.

The chapter on probability fails to include a compact statement of the conditions necessary in order that inferences may be stated in terms of probability. The conditions of an "unchanging" population, number of

observations, and independence of events often present much more formidable problems when working with economic phenomena than when testing such characteristics as yield differences between varieties under highly restricted conditions. It appears to me that discussions of design of experiments and sampling might be combined since the principal difference is in sources of observations or particular populations and not in basic logic.

References to Table 9.2 (p. 168) should be to Table 9.3. Despite the caution from H. Belloc, "The student must be careful in calculations involving the decimal point to put it in its exact place, neither too much to the right nor too much to the left." (p. 173) the decimal in the denominator of the F ratio (p. 98) was placed too far to the right! The figure should be 3.0.

In summary, it is my opinion that this book, supplemented by additional discussion of regression and characterization of measurements, and by additional problems for home work, would serve well as a text for sophomores in Agriculture. There is an acute need for such a course at the sophomore level in order that the basic statistical concepts might be used in the teaching of undergraduate courses in such fields as Agronomy, Animal Industry, and much of Economics. With the use of basic concepts of statistics rather than dogmatic rules of thumb, courses in crop production, animal feeding, and farm management could be made much more effective.

W. W. MCPHERSON

N. C. State College

World Population and Production, Trends and Outlook, W. S. and E. S. Woytinsky, New York: The Twentieth Century Fund, 1953. Pp. lxxii, 1268. $12.00.

In 1947, when the experts were outguessing each other as to the future of the American economy, W. S. Woytinsky, along with other U. S. scholars, took stock of the situation in a volume entitled *America's Needs and Resources*. Now, after more than five years of unaided labor, the Woytinskys have appeared with an "outline (1268 pages!) of world economic forces and trends during the fateful era in which mechanized economy . . . is becoming the universal civilization of mankind." A companion volume on *World Trade and Organization* is planned for publication this year also by the Twentieth Century Fund.

The format employed in the book under review is a topical survey ranging over a wide area (geography, demography, ecology, geology, technology, and economics). Area (by country or continent) comparisons and summaries are given within each section. The book begins with a stand-

ard treatment of the geomorphology of man's environment and the influence of geographic factors on human affairs. This is followed by a lengthy section on the size, growth, composition, distribution, and migratory patterns of the world's population. A consideration of vital rates and health precedes a brief section on the future growth of world population. An interesting discussion of man's consumption patterns under varying cultural conditions prepares the way for the remaining three-quarters of the book which deal with man's resources (including human resources) and techniques for achieving (in the case of underdeveloped countries) and maintaining (in the case of the most highly developed countries) these consumption levels. Throughout an attempt is made to lend historical perspective to the subject under discussion. In general, this is helpful and stimulates some of the book's most reflective moments. There is, however, a weakness for the odd and the curious that should have been resisted in a book of this bulk.

The authors seldom venture near the controversial nor do they preach. They are, however, soberly optimistic concerning the challenge facing mankind and this has already brought outcries from the neo-Malthusians. The battle is joined on page 287 when the authors state that "our modern idea of providing technical and economic aid to underdeveloped areas is based on a dynamic concept of standards of consumption and nutrition. . . . In other words, we accept the calculated risk that there will be an upsurge of population in the underdeveloped areas, as there was in the Western world and expect that this development will be offset by the spread of modern technology and science, including modern methods of utilizing land and other natural resources." The infrequent statements with policy overtones, as for example their belief (page 311) that reform of medical and educational services must precede improvement in nutrition in underdeveloped areas, are all based on the premise that technology will see us through.

The major criticism which this reviewer has of the book is that if "an overall picture of the world" is to be achieved it is up to the reader to put it together. Chapter by chapter the book is excellent and while it is probably unreasonable to expect a diagnosis and cure there is not even a summing up. The final chapter is on the chemical industry and ends with the anticlimactical statement that "as the manufacture of chemicals progresses, industry and agriculture throughout the world will become more and more 'chemicalized'."

There appears to be more discussion of certain statistical techniques (e.g., net reproduction rates, Lorenz curves, measurements of power and energy) than is required by the points that are being made. Similarly, classification schemes of limited usefulness are sometimes developed ap-

parently as academic exercises. This might be said of the classification of economic systems in chapter 13, a classification which incidentally cannot handle the U.S.S.R. as a subtype. The same general criticism applies to the superabundance of graphic devices that in many cases add more to the price and weight of the book than to its readability.

The authors have a tendency sometimes to develop concepts that have little meaning in terms of real societal units into which the world is organized. Rather these concepts (which are objected to because they are hard to conceive) are the result of a kind of statistical freewheeling and assume the world to be a meaningful unit of human organization, cf. their use of the term world labor force, world consumption pattern, or world per capita consumption of energy. Averages should suggest a central tendency whereas a central theme of the present book is regional and national differences.

Some of the above criticism may be overlooked if one takes the view, stated by the authors, that their book is also an introduction to international statistics. Although a more apt description might be to call it an exposure to international statistics, the authors must be credited with candor in revealing the inadequacies and pitfalls of their material. Only rarely, as when they set out after Colin Clark's theory of economic growth, do the authors appear to claim too much for their data.

In spite of these criticisms, *World Population and Production* is an excellent and worthwhile book. It should be useful to the professional whose range of competence is seldom as broad as the subject here reviewed. It is recommended also to the general reader who wants something more penetrating than a journalistic view of the world situation.

JOHN F. KANTNER

Bureau of the Census

Post-War Agricultural Problems and Policies in India, S. Thirumalai, The Indian Society of Agricultural Economics, Bombay, and Institute of Pacific Relations, New York, 1954. Pp. 280. Rupees 12.

This book is a most creditable effort to describe many of the problems facing Indian agriculture and to describe the work being undertaken by the government to meet these problems. For those readers who are unacquainted with Indian agriculture the author presents much useful background information. His historical background of agricultural policy is short and to the point until 1900. He gives some detail to the policies that were in effect from the turn of the century through the Second World War. Much of the government policy during this period was designed to prevent famine and to contribute to government revenue. Apparently, little

thought was given to improving the standard of living for the man who works the land.

Two years after World War II ended the subcontinent was divided into India and Pakistan. This division created a number of problems such as mass migration, resettlement of refugees, loss of a source of raw material such as jute and, to a certain extent, cotton, and also a market for the products of Indian industries. In spite of these losses the author gives the impression that India gained more per capita agricultural resources than Pakistan.

The author lists the "main problems" facing Indian agriculture. The list is familiar to those who have a working knowledge of agriculture in under-developed areas and are so numerous that they will not be listed in this review.

In Part II the author gives considerable information about Indian agriculture today; physical factors, acreage production, and, to a certain extent, potentialities under existing systems of farming. The data are as good as can be found and are subject to the weaknesses that are common to countries that have no strong, independent, and well-trained central statistical organization. The author does use the limited data to a very good advantage, and is the first to admit their limitations.

Part III treats some of the basic economic and social problems of Indian agriculture. The first two chapters are concerned with land reform. Although one of them is called "Farm Organization," it is more concerned with the pressure of population on the land than with farm organization. The author gives a good description of some of the more common types of land systems that exist in India and shows how complicated they are. He also points out that the solution is not easy because of the large number of land hungry people who are bidding for use of the limited resources.

The chapter on agricultural credit is especially good. The author describes credit services that are available to the farmer, and cultivator; what the government is doing to meet the problem; and makes his own recommendations for improving the situation. Credit is a major problem for the man on the land in India, and it is probably as big a social problem as it is an economic. How can a cultivator borrow money for productive purposes *only,* if he and his family do not have enough to eat?

If the lot of the cutivator is to be improved, the trained personnel must begin work with the man who has the calluses on his hands. He is the only person who is going to increase agricultural production. Unless the experts know how to reach him and how to give him an incentive, the author believes that little will be accomplished toward improving the standard of living of the majority of the people of India, much less in-

crease agricultural production for the country as a whole. In other words, the government rural workers must have a democratic rather than a bureaucratic approach.

Mr. Thirumalai, like most of his colleagues, gives little serious thought to what many outsiders look upon as a major problem that must be faced if India is to improve the standard of living of the people of the country. How can food production be increased fast enough to meet the demands of a rapidly increasing population? The author claims that about 100 million acres of additional land could be brought under cultivation if modern technology were applied. This would include greatly expanded irrigation facilities and land reclamation. Let us assume that there is enough money available to carry out such work. The big problem would be, "How can the government develop this land fast enough to meet the needs of the growing population?" The development of nearly four million acres of land a year would be a major task for any government. Such extensive expansion is not included in the Indian Five Year Development Plan. Little thought seems to be given to some means for controlling the increasing number of mouths that are coming into the world. The author does suggest the usual solution for population of pressure on the land—expand cottage industries.

One cannot help but be impressed by the thought and work that is being given by India's agricultural economists to the problem of improving the agricultural conditions of the country. They have demonstrated and are continuing to demonstrate their ability to tackle their own problems in their own way and are doing a most creditable job. This book not only describes and evaluates these efforts but also is an outstanding example of that thought and work. However, one sometimes gets the impression that these men are agricultural economists and not farm economists.

The author's statements are supported by a large number of useful statistics on Indian agriculture, including quantities of food grains consumed. The statistics are for the whole country and not for individual states. They generally are not for a time series but for recent years. The text is well footnoted, both for reference and for amplification. The selected bibliography is extensive and would be especially useful to the student of Indian agriculture.

HENRY W. SPIELMAN

American Embassy
Karachi, Pakistan

Colonial Development and Population in Taiwan, George W. Barclay, Princeton: Princeton University Press, 1954. Pp. xviii, 274. $5.00.

This is an economic and sociological study of colonial Taiwan from a

demographic approach. Population grows when the people's economic conditions are not hard and their social frameworks stable. Public sanitation and good health are other important factors for the increase of the number of a people. Fertility of women has direct bearing on the growth or decline of a population. Fertility, however, has also close relations with a society's economic pattern and the characteristics of its social organizations. Generally, where economic life is predominantly industrial and the social values less based on familial institutions, fertility would be low. In rural communities, with great emphasis on family traditions, women usually have a high fertility. These are the basic points upon which the author developed his research.

A strong Malthusian view dominates the whole work. The author regrets that colonial development purposely raised to a certain extent the levels of living of the local people by measures having little interference with indigenous customs, without affecting the formidable structure of familial institutions that the poorer people had relied upon in the past for survival. For in so doing the development reduced mortality but not fertility rates, and eventually brought forth all the hard consequences of a purely biological population growth. For the same reason, the author is critical of the present policies and practices of the Chinese National Government relative to economic reconstruction in Taiwan. To feed the population and to get economically on their own feet, "the present authorities have found it necessary to fall back upon the island's agricultural resources, and have kept as much agrarian emphasis in their methods as did the Japanese." "Insofar as this amounts to a population policy," the author comments, "it seems to favor a continuance of high fertility and, if unchanged, to offer very little promise of a decline in the rate of growth from this course" (p. 259).

The growth of the Taiwan Chinese population during the Japanese period is attributed by the author to three factors: improvements in the people's economic livelihood, improvements in public sanitation, and the lack of social changes. Economic improvements were largely limited to the increased agricultural production. The increase was cheaply achieved by introducing better varieties of rice, better fertilizers, and more effective methods of controlling plant insects and diseases. The traditional pattern of family farming and the methods and tools of cultivation, however, were not changed. The modern farm enterprises of growing and processing sugar cane and pineapples were monopolized by Japanese nationals. Efforts to increase rice production were for augmenting the food supplies of Japan. A number of big industries and businesses of international trade, transportation and banking were developed. Most of these were also in the hands of the Japanese. Chinese participation was next to nothing.

The Chinese who worked in the factories or on the company farms were low paid unskilled laborers and were a very small number among the whole population on the island. For these reasons, the disposition of the Chinese manpower, or the occupational character of the Chinese population, remained in the old patterns throughout the Japanese occupation. That is, an overwhelming majority were engaged in the traditional type of family farming, or in backward handicrafts, or in small local trades.

In emphasizing the fall of the population's mortality the author accords the Japanese full credit for their effort on behalf of the health of the inhabitants. Before the Japanese occupation, Taiwan was full of epidemic diseases. The health condition was so bad that the Japanese military forces that first invaded Taiwan were nearly overcome by sickness in their own ranks before taking possession of the island. In the first decade of occupation, the death rate among the Japanese garrison was very high. Soon the Japanese realized that in order to make Taiwan safe for themselves, drastic measures had to be taken to curb the spread of diseases, and they were very determined in carrying out the measures. In administering the health programs, the Japanese authorities did not exclude the Chinese population as they did with the economic and social welfare programs.

Thus, in a period of fifty years, there existed on the same island two different worlds: One was modern with most of the modern living facilities and conveniences available. Here lived all the Japanese nationals, only a few Chinese were allowed. The other one was the traditional world in which lived the majority of the Chinese. Here most of the conditions were kept in the old fashion. It had almost a complete lack of modern conveniences, except some of the necessary sanitation facilities. The contrast between the old and the new was especially conspicuous in the cities that grew up under the colonial development. Japanese policy vigorously discouraged social or cultural contacts between the Chinese and the Japanese. As a result, the colonial development caused very little social change in the Chinese communities. Without far-reaching social changes, the Chinese people kept their "big family" and "family continuity" ideals. Hence, the lack of a check upon the growth of the population. Culturally, the colonial authorities wanted the native people to live forever in their old social or familial patterns. The basic policy was that the so-called indigenous cultures were not to be disturbed lest the natives get new ideas and become restless. For once they indeed got new ideas, they would first disturb the social orders and later on become competitors of the people of the ruling class. The colonial authorities were afraid of both.

As far as contents are concerned, *Colonial Development and Popula-*

tion in Taiwan is a good piece of work in its field. But it is very hard to read.

MARTIN M. C. YANG*

Hartford, Conn.

Satellite Agriculture in Crisis, by the Research Staff of the Free Europe Press, New York: Frederick A. Praeger, 1954. Pp. 130. $3.50 clothbound. $2.50 paperbound.

Engels once outlined the general principle behind communist farm policies by stating: "We say frankly that . . . we can bring the peasants to our side only by making promises which we know before hand we shall not be able to keep" (p. 13). One must credit the Bolsheviks for having lived up to this precept inside as well as outside of Russia. The book tells how it was done.

Chapter I reviews The Historical Precedent created by Soviet Russia. The evaluation of the significance of the developments is extremely refreshing. The utility of the collectivization lies clearly in its efficiency as a device which aids the state in attaining economic and political control over the peasant. Without this tight control a rapid industrialization of Russia seemed impossible. Unfortunately Stalin could not have the cake and eat it too. The gain in the intensity of control—the primary objective—was therefore attained at a shockingly high cost in human misery and loss in efficiency of production. To the extent that industrialization was facilitated, one could show that Soviet farm collectivization "succeeded."

In Chapter II the pre-Communist "peasant ecology" is described.

With this general setting in mind Chapters III and IV discuss the gradual transfer of the system into the Bolshevik pattern. The variations on the collectivization theme, as practiced by the individual satellites (Czechoslovakia, Poland, Hungary, Bulgaria, Yugoslavia and Rumania), are documented with whatever statistics are available. The figures are cautiously interpreted, and plenty of warnings are issued as to their reliability.

Chapter V gives a most interesting discussion of the implications of the Post-Stalinian New Course. This recent "modus vivendi between the peasantry and the Communist regimes is precarious and unstable, at best an uneasy truce between essentially antagonistic social forces (125). That this forward looking appraisal, or prediction if you please, of the New Course was correct has already been shown by the policy declarations

* Dr. Yang is Visiting Professor of Rural Sociology, Kennedy School of Missions; formerly Professor of Sociology, Cheeloo University; author of *A Chinese Village*.

issued at the Czeschoslavak and Hungarian Party congresses, which were held in June 1954. The Communist VIP's were worried about the failure of the farmers to solve the food supply problems. The New Course has apparently not proved the panacea that its authors no doubt hoped it would be. And so, when Rakosi and Zapotocky stressed the "extreme importance" of the medium farms, their speeches were not of a kind that would instill the peasants with confidence that it is the primary intention of the regime to increase agricultural production. On the contrary, there is again, a maybe somewhat bashful but nevertheless strong emphasis on further consolidation and strengthening of unified agricultural co-operatives, i.e. collectivization.

One wonders whether the use of the word "crisis" in the title of the book is not a bit unfortunate. Are the present events really "a turning point in the progress of an affair . . . (a) sudden or decisive change in the course . . . ", as Funk and Wagnals College Standard Dictionary defines the term? The connotation of a dilemma, which the foreseeable future might be fatal to the regimes, is easily read into the title. That certainly could not have been the original intention of the authors. On the contrary, an effort is made to show that the satellites have taken many a leaf from the Russian experience, and thus have been able to avoid many mistakes committed by the "Soviet pioneers". The reviewer would have preferred to use the more neutral title "Satellite Agriculture in Transition."

One feels grateful to the staff members of the Free Europe Press–most of whom are prominent refugees from Communism–that they clearly stated the premises from which the whole Soviet farm policy developments have to be viewed. People, who partially derive their salaries from State Department funds, must be in possession of a considerable amount of courage when, in the USA of 1954, they dare to express the opinion that Russian collectivization was, judged from the Bolshevik point of view, "successful."

The comprehensiveness of coverage is gravely disturbed by the ostentations omission of Eastern Germany. Whatever the emotional justification of such action by the members of the Free Europe Press, to the present reviewer it just does not make much sense. For all intents and purposes Eastern Germany is a satellite, and ought therefore be included in the study.

The fact that Albania is left out as well is extremely unfortunate. Albania gets little publicity in the first place. This is very regrettable considering the strategic importance to Moscow, which she suddenly acquired after Yugoslavia's defection from the Cominform.

The publishers of Russian History and World Communism (the present

volume being #13 in the series), and the able editor of this "collective authorship" ought to be congratulated on a good job. The book provides a relatively comprehensive review of the last five decades of developments. The style is sober and matter-of-fact. The frequent inter-country comparisons of events illustrates the correctness of the "history repeats itself with variations" philosophy. People, who are seriously interested in the *facts* behind the Communist conspiracy would benefit greatly from studying the book very carefully.

FRANK MEISSNER

Cornell University

Food Administration in India 1939-47, Sir Henry Knight, Stanford: Stanford University Press, 1954. Pp. xii, 323. $7.50.

The administrative system in India before the last war was largely based on the philosophy of *laissez faire* and a certain sense of security regarding the country's food supply. The possibilities that there could be a great war right at the frontier of the country and that food supplies from traditional sources abroad could be completely cut off and the internal transport system completely dislocated by an unprecedented pressure of military demands never entered the calculations of the then Government of India. Every one was lulled by the belief that abundant supplies of foodgrains were available in Burma which could always be rushed in whenever any shortage developed.

When, therefore, the entry of Japan into the war in December 1941 brought with it a series of consequences which completely changed the character of the food problem of the country, the administration found itself completely unprepared to meet the crisis. Fear of invasion in the eastern parts of India led to wide-spread hoarding of stocks and consequently to a very sharp rise in prices. Free flow of commodities from producing to consuming areas was rendered difficult by the heavy pressure of essential war demands on the transport system. Considerations of military strategy led to the removal of stocks from certain strategic areas lest they should fall into the hands of the enemy. This "denial policy" increased the panic in the public mind. A severe cyclone occurred in the important rice producing areas in Bengal in October, 1942 and caused serious damage to the crop. It was followed by a severe famine in that province which according to the most conservative estimates caused the death of over 1½ million people. It was the shock of this famine which at last convinced the Government of the futility of the policy of *laissez faire* and compelled them to undertake large scale procurement, import and rationing of foodgrains on Government account and build up a food administration which either in size or in complexity has few parallels in the world.

Sir Henry Knight's book under review describes the setting up as well as the working of this administration from 1939 when the war began to 1947 when India became independent. During most of this period Sir Henry Knight was Adviser to the Governor of Bombay and was responsible for organising the procurement, supply, distribution and rationing of foodstuffs in that province which later became the model for the rest of the country. As is only to be expected, his account of the food administration in India during these crucial years—the basic problems, the inherent difficulties of the situation, the mistakes made and the solutions found—is one of the most interesting documents of the type published in recent years. It is not easy for people who are used to the homogeneous and progressive economies of the West to comprehend what a serious problem it was which confronted administrators like Sir Henry Knight in 1942-43. The task of supplying food for 400 million people is by itself difficult enough but the situation was further complicated by the fact that 90% of the people were illiterate, most of the farms were so small that the marketable surplus available from each was meagre and the country was divided into 500 and odd States, the administration of which varied from small pricipalities with autocratic rulers to large democratic provinces like Bombay where the most important political party was fighting a bitter struggle for independence against the Government of the day. Under these circumstances it was no mean achievement that the Government was able to procure 5.3 million tons and import 2.2 million tons to supply rations to 150 million persons in 1946, within three years of starting the food administration. The fact that the wholesale prices of foodgrains went up by only three times between 1939 and 1946 as against an increase in the quantity of money by six times is also another index of the success of this administration. Sir Henry Knight's conclusion that "taken as a whole, the food crisis in India showed the capacity of the traditional administrative system to improvise and expand to meet unexpected emergencies and the willingness and the ability of the Indian people to accept unusual and inconvenient measures when such were necessary" would seem, therefore, to be a fair assessment, at least so far as the period 1943-46 is concerned.

But at the same time, one should not forget that the inherent conservatism of this very administrative system, its failure to think ahead or even to learn from what was being done in other countries, especially in England, where it had its roots, and the fact that 1½ million people had to die of famine before the food administration could work with the vigor that the situation demanded is also a sad commentary on the same administration. If someone like Lord Beveridge had been called upon to prepare a food plan for India before the War and if what was done in 1943 had been done in 1939 or 1940, much distress could have been easily avoided.

Sir Henry Knight's book brings out clearly one of the inherent weaknesses of bureaucracy viz., that in its anxiety not to take even small risks it often creates situations when it is obliged to take very big risks. If procurement and rationing were considered too difficult, steps could have been taken at least to build up adequate reserve stocks. But nothing was done until the Bengal famine compelled the Government to abandon its policy of *laissez faire* and accept the need for food control. It is not that procurement and rationing were altogether unknown in India. In one of the important States viz., Kashmir, a compulsory levy of paddy from all growers and rationed supplies to the general population had been working successfully since 1921. Sir Henry admits all this and in fact goes so far as to say that "the Kashmir scheme and the difficulties and failures which led to its adoption are described in a report of August 1923 by Raja Sir Hari Singh, later Maharaja of Kashmir, Major General Janak Singh and Sir Bertrand Glancy. If this report had been taken out of its pigeonhole and early in the war studied by the Government of India and the Goverments of Provinces, perhaps some of the hesitancies and mistakes which at times marked Indian wartime food administration might have been avoided."

In the view of the present reviewer, Sir Henry has not perhaps been sufficiently critical of those who were responsible for India's food policy in the early years of the war. Much of India's difficulties were caused by their hesitancy and delay. Once, however, the Government had accepted the principle of "fair shares for all" and the necessity of undertaking large scale procurement and distribution for this purpose, the officials who were responsible for the implementation of this policy did a commendable job and fully deserve the praise which Sir Henry has bestowed on them. In fact in his understandable anxiety to be impersonal, Sir Henry has perhaps done less than justice to the few senior officials like himself who had been urging the Government from the very beginning of the necessity of setting up a strong food administration and spared themselves no pairs to build it up when at last a decision was taken to do so. In fact their vision of food control went beyond the mere feeding of the people in a time of security. They saw in it an opportunity for the first time in the history of the country for stabilizing the farmers' prices at an economic level and for meeting the long felt need of improving the nutritional conditions of the people. It is through their efforts that the principle of "fair shares for all"—that no one should starve on account of high prices of food and that food should be available equally to the sweeper and the millionaire—was seen in action for the first time in India.

The administrative system which they set up no doubt manifested certain defects in subsequent years. It led to conflicts as between surplus

and deficit areas, it gave rise to corruption amongst petty officials, and it involved the imposition of irksome controls on the producer which discouraged food production and had to be relaxed considerably in the interest of increasing production as soon as the situation of acute shortage was over. But, during the years 1943 and 1946 when the main problem was to meet the basic requirements of the vlunerable groups of the population at reasonable prices out of limited supplies—there is no doubt that the food administration as set up by Sir Henry Knight and his colleagues was able to carry out satisfactorily the duties which were assigned to it.

S. R. SEN

Directorate of Economics and Statistics,
New Delhi.

Mortgage Lending Experience in Agriculture, Lawrence A. Jones and David Durand, Princeton, New Jersey: Princeton University Press, 1954. Pp. xxii, 235. $5.00.

This is the second publication in a series of studies of agricultural finance undertaken by the National Bureau of Economic Research and is a welcome addition to the literature in this field. The volume is concerned largely with the identification and description of geographic areas having different amounts of farm mortgage distress in the two decades between the world wars, and with the analysis of the reasons for their differences. Teachers and students will find it a valued reference; it contains much material that farm mortgage lenders can study to their advantage; and it sharpens the focus on numerous questions that researchers in the field of farm finance may be stimulated to investigate further.

The introductory section consists of a fact-crammed 20 page historical sketch of interwar trends in farm prices, income, debt, and real estate values in the United States, and quite adequately sets the stage for the more detailed description of mortgage experience in individual areas that follows.

Part I is divided into five chapters, the first of which describes the basic data used to measure farm mortgage distress and includes a series of 15 maps on which are plotted measures of various factors related to mortgage lending experience. Four areas of "good" and five areas of "poor" mortgage experience are delineated on the final map in the series. These are discussed in some detail in the succeeding four chapters.

Part II deals with the debt carrying capacity and mortgage experience of individual farm businesses within regions and type-of-farming areas. It includes four chapters which, in order, review mortgage experience studies; farm income studies; market values, earning power, and lending

standards; and causes of mortgage distress, recent adjustments, and continuing problems.

The book concludes with two appendices, the first of which analyzes the findings of nine separate mortgage experience studies and includes material that is destined to become assigned reading in many farm finance courses.

While this volume contains little that is controversial or that will change the basic content of courses in farm finance, it provides a comprehensive and much improved documentation of farm mortgage distress in the interwar years. It may be of special interest to those for whom the disastrous impact of drought and depression in the thirties has completely overshadowed other causes of mortgage distress. The boll weevil, land drainage taxes, the level and variability of crop yields, shifting technology, and the circumstances in which land was settled were major contributing factors at certain times in some areas. The reader is reminded also that the geographical patterns of mortgage distress in the 1920's and the 1930's were quite different.

Although land values are treated only in their relationship to farm mortgage distress, the study provides much reinforcement for the widely held views that "good" land tends to be undervalued relative to "poor" land both in the real estate market and by mortgage lenders but that the trend in land values provides a fairly good barometer of "how farmers are doing." Explanations for past discrepancies in valuation of land are reviewed and evaluated and it is suggested that progress is being made toward more accurate appraisals by both purchasers and lenders. The authors conclude, however, that "it is obvious that, in the last analysis, farm mortgages default and are forcelosed because farm incomes fail to achieve expectations." They draw attention to a number of recent adjustments that may have mitigated the price and production hazards of farming and, therefore, may make it easier to forecast future farm incomes. Included in the list are Government price support and crop insurance programs, improved control of insects, diseases, and weeds, better knowledge of production limitations and a greater awareness of dangers in overborrowing, and finally, progress in the adaptation of credit terms to the special needs of agriculture. Nevertheless, "there is every reason to believe that the twin problems of making accurate appraisals and adjusting loans to repayment ability will continue to be difficult in the future, even if less difficult than in the past." In the continuing struggle with the various facets of this problem, the material in this volume will prove very useful.

ERNEST T. BAUGHMAN

Federal Reserve Bank of Chicago

Rural Social Systems and Adult Education, A Committee Report by Charles P. Loomis, Chairman and J. Allan Beegle, editor. East Lansing: Michigan State College Press, 1953. Pp. 392, $5.00.

Loomis and Beegle are the authors of the textbook, "Rural Social Systems" which is an analysis of rural society making use of the concept of social systems. This report also utilizes the conceptual scheme as propounded in the textbook.

The current report is based on a nation-wide study of the broad field of rural adult education with rural meaning all areas of less than 2500 people and adult education embracing the whole gamut of interrelationships from formal school courses to the informal means of adult interaction such as radio and television.

The study was carried on by members of the professional staffs of the Division of Farm Population and Rural Life of the Bureau of Agricultural Economics, the Extension Service of the United States Department of Agriculture, and the Agricultural Experiment Station of Michigan State College. It was sponsored by the Association of Land Grant Colleges and Universities and by the Fund for Adult Education established by the Ford Foundation.

The report is divided into fourteen chapters which deal with rural adult education in general and with such specific agencies and organizations as the public schools, churches, Extension Service, Farmers' organizations, public libraries, civic clubs, and units of local government.

J. Allan Beegle is the editor of the report with chapters being written either individually or jointly by Charles P. Loomis, Olen E. Leonard, T. Wilson Longmore, Sheldon G. Lowry, Joseph L. Matthews, Frank C. Nall, Jack J. Preiss, Wayne C. Rohrer, Orden C. Smucker, Carl C. Taylor, John F. Thaden, Ruth Warncke and Edward W. Weidner.

The study was focused by direction of the sponsors on the three subject-matter fields of (1) international understanding for peace, (2) strengthening of democracy, and (3) understanding and strengthening the economy. It is readily discerned that adult education covering these three fields would be broad indeed.

The report is base on returned questionnaires and of observations of certain key people. The method of study is adequately described and a helpful feature is the inclusion in the Appendix of the questionnaires used and a statement of the methodology employed.

Although this report was directed and carried out by sociologists, the results are significant to agricultural economists and indeed to anyone interested in the interrelationships of the various social systems operating in the field of rural adult education. It certainly should be available to and studied by the people working with and through the various agencies

and organizations studied. With the increasing material culture and the increase in the number of adults in our society, the findings of the study will be of increasing importance.

VIRLYN A. BOYD

Clemson Agricultural College

JOINT SESSIONS
AMERICAN FARM ECONOMIC ASSOCIATION
AND
OTHER PROFESSIONAL ASSOCIATIONS
HOTEL STATLER, DETROIT, MICHIGAN
DECEMBER 27-30, 1954

Tuesday Evening, December 28, 8:30 p.m.—With American Economic Association

CURRENT PROBLEMS IN AGRICULTURAL ECONOMICS

Chairman: T. W. Schultz, University of Chicago
Papers: The Supply Function of U. S. Farm Products Under Conditions of Full Employment—Earl Heady, Iowa State College
Trade and Foreign Investment Implications of the U. S. Farm Products Disposal Program—Martin Bronfenbrenner, University of Wisconsin
Discussants: D. Gale Johnson, University of Chicago
D. R. Kaldor, Iowa State College

Wednesday Morning, December 29, 9:00 a.m. (tentative)—With Econometric Society

SURVEYS OF ECONOMIC RESULTS IN AGRICULTURE

Chairman: Joseph Ackerman, Farm Foundation
Papers: Demand and Prices—Richard Foote, Agricultural Marketing Service, USDA
Production Economics—Glenn Johnson, Michigan State College
Sample Surveys and Experimental Design—Max Brunk, Cornell University
Discussants: D. Gale Johnson, University of Chicago
George Kuznets, University of California

Wednesday Afternoon, December 29, 2:00 p.m., (tentative)—With Econometric Society

RECENT ECONOMETRIC STUDIES IN AGRICULTURAL MARKETING

Chairman: Harry C. Trelogan, Agricultural Marketing Service, USDA
Papers: Markets for Watermelons—Daniel B. Suits, University of Michigan
Management of Meat Inventories—George Tolley, University of Chicago, and Cleon Harrell, North Carolina State College
Scale Returns in Agricultural Marketing Firms—Guy Black, University of California
Discussants: Cecil B. Haver, North Dakota Agricultural College
Gerhard Tintner, Iowa State College

Wednesday Evening, December 29, 6:30 p.m.—Dinner for Agricultural Economists

(For reservations write Robert Kramer at Michigan State College)

THE AGRICULTURAL ECONOMIST IN THE POLITICAL ENVIRONMENT OF POLICY MAKING

Paper: Earl Butz, Assistant Secretary of Agriculture, Washington, D.C.

NEWS NOTES

Awards for 1955

The American Farm Economic Association will make the following awards in 1954: (1) Award for the best article published in the *Journal of Farm Economics* in 1954, (2) Awards for published reports of research in the field of Agricultural Economics, and (3) Awards for theses submitted in partial fulfillment of requirements for the degree of Doctor of Philosophy in departments administering majors in Agricultural Economics.

Award for Best Journal Article

For the article judged best among those published in the Journal of Farm Economics during the calendar year 1954 an award of $100 will be made. The selection will be made by the Editorial Council.

Awards for Published Reports of Research in Agricultural Economics

1. For the year 1955, there will be three awards of $250 each. Each award will be in a different field of Agricultural Economics.
2. Publications including bulletins, articles, and pamphlets submitted for consideration will be classified in the following fields, and persons submitting items should indicate the field in which they believe the reports should be classified. (Books are not to be included.)
   (a) Farm management and production economics
   (b) Agricultural marketing
   (c) Agricultural prices
   (d) Agricultural finance
   (e) Land economics
   (f) Theory and methodology
   (g) Agricultural policy
3. Selections will be made from published research bearing the publication date of 1954.
4. Only publications prepared by persons 40 years of age or less at the time of publication will be considered.
5. A report of research published in the *Journal of Farm Economics* by a person 40 years of age or less at time of publication may be entered and considered for an award for published research. It will also receive consideration for the best *Journal* article, but may receive only one award.
6. The Awards Committee for Published Reports will be made up of seven persons, in addition to the Chairman, representing the various fields which have been designated.
7. Publications must be in the hands of the Chairman of the Committee, H. Brooks James, Department of Agricultural Economics, North Carolina State College, Raleigh, North Carolina, on or before *March 1, 1955*. Eight copies in each publication entered are requested, but fewer copies will be accepted in such cases as articles appearing in national journals or books otherwise available to the judges. In no event should less than three copies be sent.
8. Members of the Awards Committee for published Reports will not be eligible to submit papers of their own.
9. Announcement of the awards will be made on or before the time of the 1955 annual meeting of the American Farm Economic Association.

Awards for Ph.D. Theses

1. For the year 1955 there will be three awards of $250 each for Ph.D. theses.

2. Theses in any field of Agricultural Economics may be submitted. Theses prepared by candidates for the Ph.D. degree in any department of Economics or Agricultural Economics in the United States are eligible for consideration, when submitted by the head of the department in which the work was done. No department, however, may submit more than one theses.

3. Selections will be made from theses submitted to a graduate school faculty during the calendar year 1954.

4. A published Ph.D. thesis may be entered in both the published report and the Ph.D. thesis classes but shall be eligible for only one award.

5. Theses must be in the hands of the Chairman of the Committee, H. Brooks James, Department of Agricultural Economics, North Carolina State College, Raleigh, North Carolina, on or before *March 1, 1955.*

6. The Theses Awards Committee will be made up of three persons in addition to the Chairman.

7. Announcement of the awards will be made on or before the time of the 1954 annual meeting of the American Farm Economic Association.

Joseph Ackerman, President

NOTE: The Awards Committee solicits the cooperation of members of the Association in encouraging participation in the program. Recognizing the reluctance of some authors to enter their own published reports, members may encourage them to do so, or arrange for others to submit published reports on behalf of eligible authors.

Announcements of the Awards Program suitable for posting are available upon request to the chairman of the Committee.

See back cover page of Proceedings issue of the JOURNAL for the announcement of the recipients of the 1954 awards.

Under the reorganization of the Department of Agriculture, the Production Economics Research Branch, Agricultural Research Service, is organized as follows: Chief, Carl P. Heisig; Assistant Chief, Ernst H. Wiecking:

Section	*Head*	*Assistant Head*
Agricultural Finance	Norman J. Wall	Fred L. Garlock
Farming Efficiency	O. J. Scoville	Martin R. Cooper
Land and Water	Harry A. Steele	Mark M. Regan
Production, Income & Costs	Kenneth L. Bachman	Wylie D. Goodsell
Northern Field Research	H. L. Stewart	C. W. Crickman and Buis T. Inman
Southern Field Research		Max M. Tharp
Western Field Research		Warren R. Bailey

Joseph Ackerman has been named Managing Director, Farm Foundation, January 1, 1955 replacing Frank W. Peck who has retired.

R. L. Adams of the University of California retired as of July 1, 1954. He is now making his home in Pacific Grove on the Monterey Peninsula.

Oddvar Aresvick, Department Head at the Royal Agricultural College of Norway, is spending a four month period in study and research at Iowa State College.

Julian Atkinson joined the staff of Purdue University as an Assistant Professor in the area of agricultural finance and farm management, September 1, 1954. He is a native of Georgia and recently completed his graduate work at Purdue.

Recent reorganization of Agriculture at Clemson provides for a dean of agri-

culture and directors of agricultural teaching, experiment station, and extension. Department heads now have additional responsibilities in their respective fields. This means that Dr. G. H. Aull is now in charge of all agricultural economics subject matter at Clemson including teaching, research and extension.

C. B. Baker was promoted to Associate Professor at Montana State College effective July 1.

Rudolf J. Becker has left the Agricultural Finance Section, Production Economics Research Branch, to join the Tennessee Valley Authority in Knoxville.

John D. Black returned to Harvard on June 24th after 66 days of heated activity in India. The report of the review of agricultural economics research, teaching, and administration, prepared by him and Hugh L. Stewart of the USDA, is now being published by the government of India.

Dwight Blood joined the staff at Colorado A & M College as Assistant Economist. He recently completed his Master's degree at Montana State College.

Howard J. Bonser, Sociologist at the University of Tennessee, has returned from a year's graduate study at Pennsylvania State University where he completed the preliminary work toward his Ph.D. degree.

Bernard Bowlen has been appointed Assistant Professor at Kansas State College where he will assume leadership for the North Central Regional Project in Wheat Price and Income Policy.

James D. Bromley, formerly at Purdue, has moved to the University of Rhode Island as Consumer Education Specialist.

Wilbur F. Buck, who was with Federal Land Bank and the Production and Marketing Administration in Massachusetts for a number of years, has accepted a position with the Fruit and Vegetable Branch, Farmer Cooperative Service, USDA.

R. T. Burdick retired as Head of the Department of Economics and Sociology at Colorado A & M June 30.

Earl Butz, Purdue, assumed his new duties August 1 as Assistant Secretary of Agriculture for Marketing and Foreign Agriculture.

H. Bruce Bylund has been appointed Assistant Professor in Rural Sociology at the Pennsylvania State University to work on basic consumer studies.

William M. Carroll has been appointed Assistant Extension Professor at the Pennsylvania State University.

H. C. M. Case, Head of the Department of Agricultural Economics, University of Illinois, has been named Executive Secretary-Treasurer of the International Conference of Agricultural Economists. He will be relieved as Head of the department at Illinois as soon as his successor can be named. Professor Case will remain as a member of the staff on half-time appointment, the remainder of the time being spent with the international organization.

Norman L. Collins has been appointed Assistant Professor at Kansas State College to teach Market Prices and do research in prices in fruit and vegetable marketing. He completed graduate study at Harvard University two years ago and was on active duty in the army from June 1952 until July 1954.

James H. Copp, who received the Ph.D. degree from the University of Wisconsin in June, has been appointed Assistant Professor at Kansas State College to conduct research in Rural Sociology.

Robert L. Clodius, Associate Professor of Agricultural Economics, is on leave from the University of Wisconsin to the Moffett Program in Business and Agriculture at Harvard University until February 1, 1955.

Dennis E. Crawford was promoted to Associate Agricultural Economist, South Carolina Experiment Station, effective July 1, 1954.

Reynold P. Dahl, who received his Ph.D. in August, University of Minnesota, has been appointed Assistant Professor at that institution.

Pete P. Dorner, Assistant Professor and Assistant Agricultural Economist at the University of Tennessee has accepted an Assistant Professorship at the University of Wisconsin.

W. L. Dorries completed his work for the doctorate at Texas A & M in August and accepted a position as Assistant Agricultural Economist at Alabama Polytechnic Institute.

Miss Rita Dubois, leader of the consumer education project on milk and dairy products, has completed transfer of headquarters from Raleigh, North Carolina to Washington, D.C. Miss Dubois is a member of the Division of Agricultural Economics Programs, Federal Extension Service.

Alfred Eckert has been appointed Assistant Agricultural Economist at the University of Nebraska to work on price policy research.

Lavon Fife has resigned from his position at Purdue University in order to join the Product Planning and Programming Division of the Tractor and Implement Section, Ford Motor Company.

Walter D. Fisher has been granted a Social Science Research Council Faculty Fellowship which provides opportunity to devote half time to research during a three year period. His research project deals with methods of determining demand for consumer semi-durable goods.

W. Truman Fossum was awarded the Norman Jay Colman award for 1954 by the American Association of Nurserymen.

Karl Gertel, Production Economics Research Branch, has transferred from Nebraska to State College, Pennsylvania. He will work on problems of utilization of abandoned and idle farm land.

M. C. Guether came to the University of Illinois on September 1 as Extension Specialist in fruit and vegetable marketing. He replaces G. C. Kleiman who took a position with Produce Department, Inc., Grand Rapids, Mich., on July 1.

Lowell Hardin has been designated as Acting Head of the Agricultural Economics Department at Purdue.

P. V. Hemphill has been appointed Acting Head of the Agricultural Economics Department at North Dakota Agricultural College.

Edward B. Hogan was promoted to Research Associate at the University of Rhode Island, July 1, 1954.

Helmer C. Holje returned to the Montana State College faculty as Assistant Professor on July 1 after a year of graduate study at the University of Wisconsin.

Roy E. Huffman of Montana State College spent the month of August in Washington, D.C. as a consultant to the Task Force on Water Resources and Power of the Hoover Commission.

Robert F. Hutton has been appointed Assistant Professor in Farm Management at the Pennsylvania State University. He had been agricultural economist with TVA.

An Institute on Economic Development was held at Vanderbilt University August 30-September 24, under a contract with the Foreign Operations Administration. This Institute, attended by 48 technical specialists from 22 countries, had a full-time staff which included Professors Rendigs T. Fels, James W. Ford, Richard T. Selden, and Anthony M. Tang of Vanderbilt University, and Mr. P. S. N. Prasad, Executive Director (India) of the International Monetary Fund. Among the guest lecturers were Arthur E. Burns, George Washington University; Walt W. Rostow, Massachusetts Institute of Technology; B. U. Ratchford, Duke University; Irving H. Siegel, Twentieth Century Fund; War-

ren S. Thompson, Miami University; James M. Barker, Sears, Roebuck and Company; George Brandow, Pennsylvania State University; T. W. Schultz, University of Chicago; Walker Cisler, Detroit Edison Company; and Walter Radius, U. S. State Department.

Mrs. Claire Frazier Jones will serve as Assistant in Agricultural Economics at Alabama Polytechnic Institute to work on a regional food marketing project.

W. E. Jones, formerly of the Mississippi Extension Service, has joined the Division of Agricultural Economics Programs, Federal Extension Service. He will work with State extension services in developing educational programs pertaining to assembly and terminal market facilities. Mr. Jones, a graduate of Mississippi State College, has had graduate work at Illinois, and has served as county agent and State extension marketing specialist.

Edward Johnson, Pennsylvania State University, has been appointed Assistant Agricultural Economist by the Maine Agricultural Experiment Station to work at the Maine Potato Handling Research Center at Presque Isle, Maine. He will assume his duties about October 1.

Gordon King has been appointed to the staff of the Agricultural Marketing Service.

Marvin W. Kottke, formerly at the University of Minnesota, is now Assistant Professor of Agricultural Economics, Louisiana State University.

Leonard Kyle transferred to Michigan State College on October 1 as Extension Specialist in Farm Management from the University of Illinois.

D. G. Lafferty has resumed full-time research duties with the University of Arkansas after completing a year's work toward his doctorate at the University of Illinois.

Ellis W. Lamborn, formerly Head of the Department of Economics, Alma College, Alma, Mich., has joined the staff at Utah State Agricultural College to do research in fruit marketing.

Norman Landgren, has been appointed Assistant Agricultural Economist at the University of Nebraska to work on livestock marketing research.

C. K. Laurent resigned as Cooperative Agent of the Southern Regional Poultry Marketing Committee to become Associate Agricultural Economist at Alabama Polytechnic Institute.

Jerry M. Law of the University of Minnesota is now Assistant Professor of Agricultural Economics, Louisiana State University.

Don L. Long, who received his Ph.D. degree at Cornell University in February 1954, has joined the staff at Ohio State University as Assistant Professor in Consumer Food Marketing Extension. He is working on a Regional (Indiana, Kentucky and Ohio) Consumer Food Marketing Project at Cincinnati.

Erven J. Long returned in Mid-September from a 3½ months' assignment in the Belgian Congo.

Glynn C. McBride, formerly at the University of Wisconsin, has joined the staff at Michigan State College as Assistant Professor, effective September 1.

Francis B. McCormick was promoted to Assistant Professor at Ohio State University.

Miss Joan McKerley and Mrs. Janel Mills Haack have been added to the extension staff at the University of Wisconsin and will take the leadership in the consumer education program.

Leonard F. Miller of Pennsylvania State University has been appointed Head of the Agricultural Economics Department at Oklahoma A & M College.

Ross Milner has been appointed Assistant Professor in Extension Farm Management at the Ohio State University, effective September 1.

Glen H. Mitchell has been appointed Assistant Professor in Dairy Marketing research at Ohio State University.

Joe R. Motheral, Production Economics Research Branch, is leaving for the Philippines for a year's assignment with FOA.

William H. Nicholls returned to Vanderbilt University on August 1 after spending ten months as Agricultural Economist on the staff of the President's Council of Economic Advisers. During August and September he served as Director of the Vanderbilt-FOA Institute on Economic Development.

Willard F. Mueller from Vanderbilt University joined the staff of the University of California (Davis campus) on September 1.

Peter Nelson has retired as Head of the Agricultural Economics Department at Oklahoma A & M College.

Russell O. Olson was appointed part-time as Associate Professor in Agricultural Economics teaching at Ohio State University. He will continue his work with the Production Economics Research Branch of the ARS stationed at Ohio State University. Under special arrangements he will be granted leave for the work with Ohio State University.

Albert L. Owens was promoted to Associate Professor at the University of Rhode Island, July 1.

K. H. Parsons is spending the first semester of 1954-55 in the Middle and Far Eastern countries on an assignment surveying the opportunities for aiding resource development programs. The University of Wisconsin is cooperating with FOA and FAO on this assignment.

Mrs. Olive W. Parrish has been appointed Assistant Professor in Consumer Food Marketing Extension at the Ohio State University, effective August 1. She is working on a Regional (Indiana, Kentucky and Ohio) Consumer Food Marketing Project at Cincinnati.

Alvah L. Perry has returned to the University of Maine after a year's leave of absence for graduate study at the Pennsylvania State University.

R. D. Rehnberg has been appointed Acting Head of the Department of Economics and Sociology at Colorado A & M College.

Robert Reierson joined the staff of the University of Wisconsin in Livestock Marketing on September 16.

Irwin W. Rust, who just obtained his Ph.D. degree at the University of Maryland, joined the staff of the Farmer Cooperative Service, USDA. He will work in the field of fruit and vegetable marketing.

Frederic O. Sargent joined the staff at Colorado A & M College as Assistant Economist. He received his Ph.D. from the University of Wisconsin in 1952. During the last four years he has been employed with ECA, MSA, FOA, working in France and Germany.

Marvin A. Schaars, on leave of absence during April, May and June to serve as Consultant in the Foreign Agricultural Service has returned to his duties at Wisconsin. He was a member of the South European Agricultural Trade Mission appointed by the Secretary of Agriculture, and served as Coordinator of the report prepared by the four missions.

O. J. Scoville, Production Economics Research Branch, transferred from Manhattan, Kansas to Washington, D.C. in September to become head of the Farming Efficiency Section.

Edgar T. Shaudys has been appointed Assistant Professor in Farm Management research at the Ohio State University.

F. M. Simpson has been appointed Agricultural Economist, South Carolina Experiment Station. In addition he will serve his third year as Visiting Professor

of Agricultural Economics at Clemson College.

John L. Snare, Associate Agricultural Economist, Alabama Polytechnic Institute, resigned his position July 31 to farm and work on his thesis.

Hughes H. Spurlock, formerly at the University of Kentucky, has accepted a position as Agricultural Economist on the staff of the Dairy Branch of Farmer Cooperative Service, USDA.

Harry A. Steele, Production Economics Research Branch, transferred from Lincoln, Neb. to Washington, D.C. in September to become head of the Land and Water Section.

Thomas M. Stubblefield has been promoted from Extension Economist to Assistant Agricultural Economist in the Arizona Experiment Station to work in the field of livestock marketing.

H. R. Stucky, Extension Economist at Montana State College, has been appointed Head of the Department of Agricultural Economics at New Mexico A & M College, effective November 1. He was awarded the Ph.D. degree in June at the University of Minnesota.

Jap P. Swanson has returned to Washington State College as Assistant Professor. During the past two years he has been a research assistant at the University of Minnesota.

John R. Tedford was promoted to Assistant Professor at the University of Rhode Island, July 1.

Max M. Tharp, Production Economics Research Branch, who has been stationed in Tulsa, Oklahoma for the last 4 years, is transferring to Washington, D.C. to become Assistant Head of the Branch's newly established Southern Research Section. His assignment on the Arkansas-White-Red River Basins Resource program will be undertaken by James A. Atherton, who was stationed at Stillwater, Oklahoma until September 1.

Enoch H. Tompkins was appointed Assistant Agricultural Economist at the University of Vermont to work in dairy and livestock marketing.

M. L. Upchurch, Production Economics Research Branch, transferred from Berkeley, California to Washington, D.C. in September to become head of the Western Field Research Section.

David Weeks of the University of California is spending a year of sabbatical leave in Europe. Under the sponsorship of Padua University he will pursue a study of benefit cost analysis in relation to reclamation and land reform in Italy.

James H. White has returned to teaching and research in farm management at the University of Arkansas, after completing course work requirements for the Ph.D. at the University of Illinois.

Mrs. Loa Whitfield has been appointed Assistant Professor in Consumer Food Marketing Extension at the Ohio State University, effective August 1. Formerly she was with the Federal Extension Service but the last two years was in Pakistan with the Ford Foundation.

Coyle H. Whitworth has been appointed Agricultural Statistician to serve under F. O. Black with offices in Columbia. This work is cooperative between Clemson College and the Agricultural Marketing Service.

Delmar F. Wilken joined the staff at the University of Illinois as Extension Specialist in Farm Management October 1.

Howard C. Williams was promoted to Assistant Professor at Ohio State University.

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